

A revision of *Chrysopogon* Trin. including *Vetiveria* Bory (Poaceae) in Thailand and Malesia with notes on some other species from Africa and Australia

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Summary

Veldkamp, J.F. (1999). A revision of *Chrysopogon* Trin. including *Vetiveria* Bory (Gramineae) in Thailand and Malesia with notes on some other species from Africa and Australia. *Austrobaileya* 5(3): 503-533. *Vetiveria* Bory (Gramineae) is reduced to *Chrysopogon* Trin. resulting in 5 new combinations and the validation of 1 in *Capillipedium*. In Thailand there are 11 species (1 new) of *Chrysopogon* and in Malesia 13 species (3 new).

Keywords: Taxonomy, Poaceae, *Chrysopogon*, *Vetiveria*

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Introduction

Traditionally, *Chrysopogon* Trin. and *Vetiveria* Bory have been regarded as distinct entities, either as subgroups of *Andropogon* L., or as related, but distinct genera. Yet, one finds occasional remarks about the presence of intermediary species. That Roberty (1960) merged the two into *Chrysopogon* has not been followed or remarked upon by subsequent authors, probably because of the general aversion to his methodology and resulting system. The close relationship between the two genera was already observed by Hackel (1889: 542), who said that the two were hardly distinct, as they are united by intermediary species, and suggested that *Chrysopogon* might be derived from *Vetiveria* (l.c., t. 2).

Keng (1939: 314) noted that 'There is such a close affinity between *Rhaphis* Lour. (for *Chrysopogon*) and *Anatherum* Beauv. (for *Vetiveria*) that the intermediate forms, *Anatherum fulvibarbe* (Trin.) Keng and *Rhaphis elongatus* (R. Br.) Chase var. *filipes* (Benth.) Keng might be referred to either genus'. He defined *Chrysopogon* arbitrarily as having 1- or 2-jointed racemes and an acute to pungent callus, but remarked again that 'there are all stages of reduction from multi-jointed

racemes and of elongation of the obtuse callus in ... (*Vetiveria*) ... to the 1-jointed racemes of 3 spikelets ('triad') and to a pungent callus as in most species of ... (*Chrysopogon*)'. Blake (1944: 21) stated 'There is nothing in the structure of the spikelets to separate the genera, but the facies of the two is rather different', and so kept them apart. What these different facies are, is not explained.

Clayton & Renvoize (1986: 342) wrote: '*Chrysopogon* intergrades with *Vetiveria* via *C. sylvaticus*, and the separation of these genera is somewhat arbitrary, particularly in Australia. It is marginally justified by the convenience of treating the compact cluster of species with triads as a single entity'. And also, '*Vetiveria* ... *pauciflora*, with only 2 or 3 spikelet pairs per raceme, links (*Vetiveria*) to *Chrysopogon*'.

Among the Australian (and some Malesian) species included in *Vetiveria* by Blake (1944; followed by Simon 1993) there are some with well-developed inflorescences that have both the single triad of spikelets ('typical' for *Chrysopogon*) and the inflorescence branch with several joints ('typical' for *Vetiveria*):

V. elongata (R. Br.) C.E. Hubb. has (1-)3-6 pairs, *V. filipes* (Benth.) C.E. Hubb. (incl. *V.*

intermedia S.T. Blake) (1–)3–7, and *V. pauciflora* S.T. Blake (1 or) 2 or 3.

On the other hand Blake accepted in *Chrysopogon* *C. fallax* S.T. Blake as ‘1-jointed or very rarely ... 2-jointed’, *C. latifolius* S.T. Blake as ‘1-jointed or rarely 2-jointed’, and *C. sylvaticus* C.E. Hubb. with ‘(well-developed) racemes usually 2-, but frequently 1- or 3-jointed’, exhibiting the same states as found in his *Vetiveria* species.

A study of additional species from Asia and Africa showed a similar variability of the number of joints. Other differentiating characters sometimes mentioned are that *Vetiveria* would have a glabrous callus [it is usually at least setulose, even in *V. zizanioides* (L.) Nash], and an enclosed to shortly exserted, straight awn with a glabrous column. These characters, as distinguishing attributes, break down, too:

Chrysopogon argutus (Steud.) Trin. ex Jackson, from Mauritius and Rodriguez, has 1–6 spikelet groups per branch, a pungent, hairy callus, and a long-exserted more or less straight awn with a puberulous column.

Chrysopogon celebicus Veldk., from Celebes, has 4–7 spikelet groups, a rounded to oblique, but obtuse callus with long hairs, a well-developed straight to geniculate awn with a puberulous column.

Chrysopogon elongatus (R. Br.) Benth., from Australia, has (1–)3–6 spikelet groups, an oblique, pungent, hairy callus, and an enclosed to exserted, straight awn with a glabrous column.

Chrysopogon filipes (Benth.) Reeder from Australia and New Guinea has 1–7 spikelet groups, an oblique, pungent, hairy callus, and an exserted, straight awn with a puberulous column.

Chrysopogon fulvibarbis (Trin.) Veldk. from W. Africa has up to 6 spikelet groups, an oblique, pungent, hairy callus, and an exserted, geniculate awn with a puberulous column.

Chrysopogon gryllus subsp. *echinulatus* (Nees) Cope (1980) has 2 or 3, and occasionally even 5 spikelet groups, while

subsp. *gryllus* has triads only. Cope (1982) remarked that there is a gradual transition between the two along the Himalayan belt with an intermediary population in the Nilgiris in S. India. Accepting the distinction between the genera outlined above, the two subspecies would have to be divided over both genera! It may be noted that Roberty (1960) has this as a variety of *C. zizanioides*; as usual his taxonomy is most remarkable. Both forms have an oblique, pungent, hairy callus and an exserted, geniculate awn with a puberulous column.

Chrysopogon intercedens Veldk. from New Guinea has 2 or 3 spikelet groups, an oblique, pungent, hairy callus, and an exserted, straight awn with a puberulous column.

Chrysopogon lawsonii (Hook.f.) Veldk. from India and Thailand has 2–8 spikelet groups, an oblique, but rather obtuse distinctly hairy callus, and an exserted, geniculate awn with a puberulous column.

Chrysopogon micrantherus Veldk., from New Guinea, has 1–3 spikelet groups, an oblique, pungent, hairy callus, and an exserted, geniculate awn with a puberulous column.

Chrysopogon nemoralis (Balansa) Holttum, a very rare species with a disjunct distribution in the Malay Peninsula, Vietnam, and the Philippines, has 1–3 spikelet groups per branch, an oblique, pungent, hairy callus, and an exserted, straight awn with a puberulous column.

Chrysopogon nodulibarbis (Steud.) Henr. from S. India and Sri Lanka has up to 3 spikelet groups, an oblique, pungent, hairy callus, and an exserted, geniculate awn with a puberulous column. Bor (1960) used *C. zeylanicus* (Steud.) Thw. for this, but the choice between the equally old epithets had already been made by Hackel (1889: 554).

Chrysopogon oliganthus Veldk. based on *V. pauciflora* S.T. Blake from Australia has 1–3 spikelet groups per branch, an oblique, pungent, hairy callus, and an exserted, straight awn with a puberulous column.

Chrysopogon rigidus (B.K. Simon) Veldk. from Australia has 3–5 spikelet groups

per branch, an oblique, pungent, hairy callus, and an exserted, straight awn with a puberulous column.

Chrysopogon setifolius Stapf from Australia has 1–3 spikelet groups per branch, an oblique, obtuse, hairy callus, and no awns.

Chrysopogon sylvaticus C.E. Hubb. from Australia has 1–4 spikelet groups per branch, an oblique, pungent, hairy callus, and an exserted, geniculate awn with a puberulous column.

So, there is a gradual transition from *Vetiveria* to *Chrysopogon*, and it is not possible to maintain *Vetiveria* for even its type species, *V. zizanioides*, and its two very close relatives, *V. festuroides* (Presl) Ohwi and *V. nigritana* (Benth.) Stapf.

Celarié (1959) considered *V. zizanioides* ‘as the most primitive and possibly the ancestral form’ of *Chrysopogon* because of the transverse articulation of the several-noded partial inflorescences with well-developed pedicelled spikelets, and a short and obtuse, glabrous to setulose callus. If correct, *Vetiveria* would be the sister group of *Chrysopogon*, and I tried to find a suitable outgroup for the two using Watson & Dallwitz’s (1996) ‘Grass genera of the world’ for DELTA with a modified version of the identification program Intkey (vs. 3.18) (see Dallwitz 1980; Dallwitz et al. 1993; Watson et al. 1986). *Sorghum* Pers. appeared to be the most similar (but not necessarily most closely related!) taxon. This agrees with Clayton & Renvoize’s (1986) suggestion that *Sorghum* and especially *Sorghum* subgen. *Parasorghum* (Snowden) Garber would be the closest relative. However, the species of the latter have hairy culm nodes which have, so far, not been seen by me in any species of *Chrysopogon* or *Vetiveria*. Ho (1993) depicted hairy nodes for a species from Vietnam he called *C. lawsonii*, but which otherwise seems very similar to *C. festuroides* (Presl) Veldk.

Recently, a RAPDs study was made by Adams et al. (1998) of the relationships primarily between the cultivated races of *V. zizanioides* with some species of *Chrysopogon*, *Sorghum*, and *Vetiveria* added for comparison. The

results support the idea of a single genus, as at least *C. fulvus* (Spreng.) Chiov. and *C. gryllus* (L.) Trin. appear to be less similar to each other than to the *Vetiveria zizanioides* cluster, while *V. elongata* (R. Br.) C.E. Hubb. and *V. filipes* (Benth.) C.E. Hubb. are very close to that cluster.

Vetiveria zizanioides is of some importance as a source of aromatic oils (‘vetiver oil’ and ‘oil of vetiver roots’), and has lately been widely proposed as a very promising soil-binder (Nat. Res. Council 1993), so this name doubtlessly will continue to be widely used with the usual complaints about taxonomists always changing names. Unfortunately, science means progress, and progress means changes, and no list of ‘Names in Current Use’, as proposed by some, will or should stop that. Pulle (1952) remarked that ‘nomenclatural stability will only be reached when scientific taxonomy has been murdered and buried’.

Proposing conservation of *Vetiveria* over *Chrysopogon* seems doomed to fail, as a far greater number of new combinations would then be required, and the latter is already conserved over three others.

Chrysopogon sometimes is divided into informal groups based on the relative length of the pedicel (distinctly less than half as long as the sessile spikelet vs. more than half as long) and whether it is setose or glabrous. The relative length is in most cases a useful character, but there are exceptions, as in *C. oliganthus* and *C. rigidus*, where the length of the pedicel ranges from very short to distinctly more than half the length of the sessile spikelet in the same inflorescence.

Chrysopogon borneensis Henr. and *C. tenuiculmis* Henr. are very similar, differing for instance by the presence of hairs on the pedicel, but placement of them in different groups would seem strange in view of their overall similarity and provenance! In some cases, it appears as if the anthers of the sessile spikelets are staminodial, for instance in *C. aciculatus* (Retz.) Trin. (sometimes) and in *C. intercedens*. Two anthers in the sessile spikelet have been seen in some florets of *C. subtilis* (Steud.) Miq. and *C. tadulingamii* Sree Kumar.

Taxonomy

Chrysopogon Trin., Fund. Agrost. (1820) 187, nom. cons.; Phoenix Haller, Hist. Stirp. Helv. 2 (1768) 202, nom. superfl., non L. (1753); *Pollinia* Spreng., Pl. Min. Cogn. Pug. 2 (1815) 10, nom. rej.; *Andropogon* subgen. *Chrysopogon* (Trin.) Hack., Mon. Androp. (1889) 547; *Chalcoelytrum* Lunell, Am. Midl. Nat. 4 (1915) 212, nom. superfl. **Type:** *C. gryllus* (L.) Trin. [Lecto, fide Pfeiffer, Nomencl. Bot. 1 (1873) 745; ICBN (1994) 185].

Rhaphis Lour., Fl. Cochinch. (1790) 538, 552, nom. rej.; *Chrysopogon* sect. *Rhaphis* (Lour.) Roberty, Boissiera 9 (1960) 282, 289. **Type:** *R. trivialis* Lour., nom. superfl. [= *Chrysopogon aciculatus* (Retz.) Trin.]

Centrophorum Trin., Fund. Agrost. (1820) 106, t. 5, nom. rej. **Type:** *C. chinense* Trin. [= *Chrysopogon aciculatus* (Retz.) Trin.]

Vetiveria Bory in Lemaire, Bull. Sc. Soc. Philom. (1822) 43; *Andropogon* L. sect. *Vetiveria* (Bory) Thouars ex Benth., J. Linn. Soc. 19 (1881) 72; *Andropogon* L. subgen. *Vetiveria* (Bory) Benth. ex Hack., Mon. Androp. (1889) 542; *Chrysopogon* sect. *Vetiveria* (Bory) Roberty, Bull. Inst. Franç. Afr. Noire 22 (January 1960) 106, nom. inval.; Boissiera 9 (July 1960) 291. **Type:** *V. odoratissima* Bory, nom. illeg. [=

Chrysopogon zizanioides (L.) Roberty].

Perennials, rarely annuals. Leaves mostly basal, conduplicate to flat. Ligule a ciliolate rim. Panicles terminal, espatheate, branches usually simple, solitary to whorled; racemes 1–14-jointed, fragile, joints and pedicels slender. Spikelets paired, one sessile, one pedicelled, heteromorphous. Sessile spikelets 2-flowered, the lower floret epaleate, sterile, the upper bisexual; lanceolate in outline, laterally compressed. Callus usually pungent, oblique, sometimes rounded, blunt, usually distinctly bearded. Lower glume chartaceous to coriaceous, dorsally convex, 5–7-nerved; upper glume boatshaped, keeled, 3–5-nerved, apex usually long-mucronate. Apex of upper lemma rounded to bifid, usually awned, awn (sub)apical, terminal or from a small sinus. Lodicules glabrous. Stamens 3, rarely 2. Pedicels free of the rachis. Pedicelled spikelets dorso-ventrally compressed, from reduced to a single glume to 2-flowered, and sterile or male. $x = (5?) 10$.

Distribution: c. 45 species in the Old World tropics, with 1 in Cuba and Florida; 11 in Thailand, 13 in Malesia of which 1 or 2 are introduced.

The SE N American species suggests that the genus may already have been in existence in the early Tertiary as part of a boreotropical flora

[see Tiffney 1985].

Key to species of *Chrysopogon* in Thailand

1. Sessile spikelets callus rounded, obtuse to oblique, pungent, usually less than 2.5 mm (sometimes longer in *C. filipes*, *C. orientalis*, but then not acicular). 2
- Sessile spikelets callus more or less acicular, 3.6–6.4 mm long. – Callus setose. Column glabrous. Pedicelled spikelets lower glume glabrous. Common weed of lawns. **1. *C. aciculatus***
2. Sessile spikelets callus rounded, laterally subglabrous to ciliate at base, especially near the base of the pedicel. Awn enclosed to exerted, straight, 0–5.25 mm long. Pedicelled spikelets lower glume aculeate, especially on the nerves. – Racemes 6–14-jointed. Column glabrous. Pedicel scaberulous 3
- Sessile spikelets callus oblique, obtuse to pungent, callus setose.

- Awn long-exserted, usually geniculate, 13–60 mm long. Pedicelled spikelets lower glume glabrous to setulose. – Racemes 1–8-jointed. Sessile spikelets upper glume apex mucronate, mucro 0.75–17 mm long 4
3. Sessile spikelets upper glume apex mucronate, mucro 0.2–1.5 mm long. Second lemma awned, awn exserted, 2.5–5.25 mm long. – Roots without oil. Wild species. **4. *C. festucoides***
- Sessile spikelets upper glume apex mucous. Second lemma mucous or briefly awned, awn usually enclosed, 0–1.95(–4.5) mm long. – Roots with oil. Cultivated species **16. *C. zizanioides***
4. Sessile spikelets callus hairs white. Pedicel glabrous, smooth to apically setose. – Ligule 0.15–0.2 mm long. Leaf blades above glabrous or with a few bristles, margins and midrib underneath pectinately setulose. Panicle 9–30 by 1–3.5 cm, pale yellow to purplish. Raceme peduncles 0.6–5 cm long. Pedicel more than half as long as the sessile spikelet. Sessile spikelets lower glume apex mucous to bidentate or mucronate 5
- Sessile spikelets callus hairs golden. Pedicel setose on the edges. – Awn geniculate with contorted column 6
5. Panicle lowermost longest branch 5–8 cm long. Sessile spikelets lower glume glabrous or distally pilulose. Awn geniculate with contorted column and straight arista. Pedicelled spikelets with 1 male floret. **8. *C. lawsonii***
- Panicle lowermost longest branch 2–3.5 cm long. Sessile spikelets lower glume aculeate, especially on the nerves, and setulose. Awn straight. Pedicelled spikelets with 1 sterile floret or reduced to 2 glumes. **10. *C. nemoralis***
6. Pedicel less than half as long as the sessile spikelet. Sessile spikelets lower glume apex acute or bi-dentate. – Panicle 3–15 cm long 7
- Pedicel slightly less to more than half as long as the sessile spikelet. Sessile spikelets lower glume apex obtuse. – Panicle purplish, 7.5–20 cm long. Upper glume of sessile spikelet without a dorsal tuft of hairs. **11. *C. orientalis***
7. Panicle purplish. Upper glume of sessile spikelet without a dorsal tuft of hairs 9
- Panicle pale yellow. Upper glume of sessile spikelet with a dorsal tuft of hairs. – Ligule 0.2–0.5 mm long. Leaf blades above glabrous to puberulous, margin at base pectinate. Panicle 1.5–3 cm wide, lowermost longest branch 3–7 cm long. Raceme peduncles 2–6 cm long. Pedicel hairs 3–4.9 mm long **6. *C. fulvus***
8. Ligule 0.6–1.1 mm long. Leaf blades above puberulous, margin at base pectinate. Panicle 4–6 cm wide, lowermost longest branch 6–9 cm long. Raceme peduncles 5–8 cm long. Pedicel hairs 3.9–6 mm long **12. *C. perlaxus***
- Ligule 0.2–0.4 mm long. Leaf blades above glabrous, margin at base not pectinate. Panicle 1–2 cm wide, lowermost longest branch 1–5 cm long. Raceme peduncles 1–3 cm long. Pedicel hairs 1.2–2.1 mm long. **13. *C. serrulatus***

Key to Species of *Chrysopogon* in Malesia

1. Sessile spikelets callus rounded, or oblique and obtuse to pungent 2
 Sessile spikelets callus more or less acicular. – Culms 0.15–0.5 m tall. Panicle 4–10 by 1–3 cm, purplish. Sessile spikelets callus setose. Pedicel glabrous, smooth to scaberulous. Common weed of lawns **1. *C. aciculatus***
2. Sessile spikelets callus rounded or oblique, obtuse. – Perennials.
 Panicle longest branch 3–12 cm long. Pedicel glabrous 3
 Sessile spikelets callus oblique, pungent. – Sessile spikelets callus setose 5
3. Culms 1.5–2.5 m tall. Panicle 15–33 by 2.5–6 cm, purplish.
 Sessile spikelets callus laterally ciliate at base, especially near the base of the scaberulous pedicel 4
 Culms 0.6–1 m tall. Panicle 7–12 by 0.6–2 cm, pale yellow.
 Sessile spikelets callus setose. Pedicel glabrous, smooth **3. *C. celebicus***
4. Sessile spikelets upper glume apex mucronate, mucro 0.2–1.5 mm long. Second lemma awned, awn exserted, 2.5–5.25 mm long.
 – Roots without oil. Wild species **4. *C. festucoides***
 Sessile spikelets upper glume apex muticous. Second lemma muticous or briefly awned, awn usually enclosed, 0–1.95(–4.5) mm long. – Roots with oil. Cultivated species **16. *C. zizanioides***
5. Pedicel at least apically setose. – Perennials. Panicle 3–15 cm long, lowermost longest branch 1–6 cm long. Malay Peninsula, Sumatra, Borneo, Philippines 6
 Pedicel glabrous, smooth, or scaberulous. – Unknown from Sumatra, Borneo 9
6. Panicle lowermost branches whorled. Awn geniculate with contorted column and straight arista. Sessile spikelets anthers 2–4.3 mm long. Pedicel setose on the edges. – Malay Peninsula, Sumatra, Borneo 7
 Panicle lowermost branches solitary to paired. Awn straight. Anthers 1.4–1.7 mm long. Pedicel at most apically setose. – Panicle with many spikelets, purplish. Malay Peninsula, Philippines (Panay) **13. *C. nemoralis***
7. Panicle with many spikelets, purplish. Sessile spikelets anthers 2.25–3.75 mm long. – Malay Peninsula, Sumatra. 8
 Panicle with few spikelets, pale yellow. Sessile spikelets anthers 2–2.2 mm long. – Sessile spikelets lower glume setulose, apex acute. Borneo **2. *C. borneensis***
8. Pedicel slightly less to more than half as long as the sessile spikelet. Awn 30–57.5 mm long, column hairs 0.2–0.9 mm long. – Callus 1–3.5 mm long, hairs 1.7–2.85 mm long. Upper glume mucro 8–17 mm long **11. *C. orientalis***
 Pedicel much less than half as long as the sessile spikelet. Awn 18–30 mm long, column hairs 0.1–0.15 mm long. – Callus 0.9–1.5 mm long, hairs 1.6–1.9 mm long. Upper glume mucro 6–10 mm long **13. *C. serrulatus***
9. Perennials. Panicle lowermost longest branch 1.4–13.5 cm long 10
 Annuals. Panicle lowermost longest branch 0.7–1 cm long. – Culms 0.1–0.4 m tall. Panicle 1–4 cm long, with few spikelets.

- Sessile spikelets 4.5–6 mm long (incl. callus), callus hairs golden, lower glume apex obtuse. Sessile spikelets anthers 0.85–1.2(–1.65) mm long. E. Java, Madura, Sumba, Luzon **14. *C. subtilis***
10. Panicle 9–30 cm long, with many spikelets. Sessile spikelets lower glume apex acute or bi-dentate, not mucronate. – Malay Peninsula or New Guinea **11**
- Panicle 3–8 cm long, with few spikelets. Sessile spikelets lower glume apex obtuse, or mucronate, or bi-dentate and mucronate. – Sessile spikelets anthers 1.5–2.25 mm long. Lesser Sunda Isl **15. *C. tenuiculmis***
11. Panicle lowermost branches whorled, lowermost longest branch 4.8–13.5 cm long. – New Guinea. **12**
- Panicle lowermost branches paired or solitary, lowermost longest branch 2–3.5 cm long. – Culms 0.4–0.9 m tall. Sessile spikelets 5.6–8.25 mm long (incl. callus), callus hairs golden. Sessile spikelets anthers 1.4–1.7 mm long. Malay Peninsula, Philippines (Panay) **10. *C. nemoralis***
12. Culms 1.6–2 m tall. Sessile spikelets 5.3–7.1 mm long (incl. callus), callus hairs white. Sessile spikelets anthers 0.6–1.5 mm long **13**
- Culms 0.7–1.5 m tall. Sessile spikelets 8–10.6 mm long (incl. callus), callus hairs golden. Sessile spikelets anthers 2.25–3.9 mm long. – Panicle lowermost longest branch 6–13.5 cm long. Raceme peduncles 1.3–8 cm long, scaberulous. Awn straight, 10–35 mm long. Pedicel 3.75–8 mm long **5. *C. filipes***
13. Panicle lowermost longest branch 7c. 4.8 cm long. Raceme peduncles c. 3 cm long, smooth. Sessile spikelets 6.6–7.1 mm long (incl. callus), callus hairs 1.2–1.6 mm long. Awn straight, 15–16 mm long. Sessile spikelets anthers 1.3–1.5 mm long. Pedicel 4.1–4.5 mm long **7. *C. intercedens***
- Panicle lowermost longest branch 6.5–7.5 cm long. Raceme peduncles 4–4.5 cm long, scaberulous. Sessile spikelets 5.3–6.3 mm long (incl. callus), callus hairs 1.8–3.6 mm long. Awn geniculate with contorted column and straight arista, 5.2–14 mm long. Sessile spikelets anthers 0.6–1 mm long. Pedicel 2.25–3.4 mm long **9. *C. micrantherus***

1. *Chrysopogon aciculatus* (Retz.) Trin., Fund. Agrost. (1820) 188;

Andropogon aciculatus Retz., Obs. 5 (1789) 22 ('*aciculatum*'); *Rhaphis trivialis* Lour., Fl. Cochinch. (1790) 553, nom. superfl.; *Andropogon acicularis* Willd., Sp. Pl. ed. 4, 4 (1806) 906, orth. var. = *Andropogon aciculatus* Willd.; *Rhaphis acicularis* (Retz.) Desv., Opusc. (1831) 69, orth. var. = *Rhaphis aciculatus* (Retz.) Desv.; *Chrysopogon trivialis* Walker-Arnott & Nees, Nov. Act. Nat. Cur. 19, Suppl. 1

(1841) 39, (1843) 171 (by inference, reference to basionym not given, no description), nom. superfl.; *Chrysopogon acicularis* Duthie, Grass. N.W. Ind. (1883) 22, orth. var. = *Chrysopogon aciculatus* (Retz.) Trin.; *Rhaphis aciculatus* (Retz.) Honda, Bot. Mag. Tokyo 40 (1926) 103; *Rhaphis zizanioides* var. *aciculata* (Retz.) Roberty, Petite Fl. Ouest-Afr. (1954) 403, nom. inval. **Lectotype:** Koenig in Hb. Retz. (holo: LD, K neg. 7082, photo in BRI; here proposed).

[*Kudirra-pullu* Rheede, Hort. Malab. 12 (1693) 79 ('97'), t. 43].

[*Gramen aciculatum* Rumph, Hb. Amb G. (1750) 13, t.5, f.1]

Andropogon subulatus Presl, Rel. Haenk. 1 (1830) 341; *Chrysopogon subulatus* (Presl) Trin. ex Steud., Nomencl. ed. 2, 1 (1840) 93, 360. **Type:** *Haenke* s.n. (holo: PR).

[*Rhaphis javanica* Nees in Hook., J. Bot. Kew. 2 (1850) 99, nomen for Cuming 555 from the Philippines; the specimen in TCD is labeled '*Chrysopogon javanicum*' by Nees himself.]; *Andropogon javanicus* Steud., Syn. 1 (1854) 396 ('Java'). **Lectotype:** *Junghuhn* s.n. (holo: P; iso: L?; here proposed).

Chrysopogon aciculatus var. *longifolius* Buse, Pl. Jungh. 3 (1854) 361. **Type:** *Junghuhn* s.n. (holo: L no. 908.86-159).

Perennials. Culms 0.15–0.5 m tall. Ligule 0.1–0.3 mm long. Leaf blades flat to conduplicate, 1.5–6(–23) cm by 3–7 mm, adaxially glabrous, with margins spiny. Panicle 4–10 by 1–3 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled (or sometimes with one or a few separate branches below the lowermost whorl), with longest branch simple, 1.5–2.7 cm long. Raceme peduncles 1.3–2 cm long, smooth, with a terminal triad, and rarely with up to 4 spikelet groups per branch (fide Roberty, 1954, 1960, see note). Sessile spikelets 7.5–9 mm long (incl. callus), callus more or less acicular, 3.6–6.4 mm long, setose, with hairs 0.45–1.1 mm long, golden. Lower glume smooth, setulose, with apex acute to bi-dentate. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, mucro (0.5–)1–1.9 mm long. Second lemma awned, the awn exserted, straight, 5.25–8 mm long, with column glabrous. Anthers 3, (0.5–)0.8–1.25 mm long. Pedicel 2.25–3.75 mm long, more than half as long as the sessile spikelet, glabrous, smooth to scaberulous upwards. Pedicelled spikelets with 1 male floret rarely reduced to only 2 glumes, 4.9–7.1 mm long. Lower glume smooth, setulose, muticous to mucronate, with mucro

0–1.05 mm long. Upper glume muticous, rarely mucronate, with mucro 0–1.1 mm long. Anthers 1.5–2.7 mm long. $2n = 20$.

Distribution, habitat and ecology: Tropical Asia, Polynesia, throughout Malesia (but not yet seen from Bali or Brunei), introduced elsewhere. Said to be introduced in Malesia as well, at least in the Philippines [Merrill, Sp. Blanc. (1918) 62] but already known to Rumphius from Ambon (end 17th century). Dry, sunny localities, open grasslands, lawns, beaches, along roads, in teak forest, etc.; at 0 to 1250(–2000) m altitude; resistant to trampling and fire; vegetation-forming.

Uses: 'Lawns, ground cover in erosion control, may become a noxious weed because the diaspores adhere to clothing and fur and may penetrate the skin in man and cattle causing itches and sores. Eaten by horses and cattle when not in fruit but of low nutritional value.

Vernacular name: Love grass (E.) (because the diaspores adhere to passing objects).

Notes: In former times this species was regarded as belonging to a distinct genus (*Rhaphis*) because of its very long callus, that is obliquely attached to the top of the peduncle of the raceme. Usually this species has only a single terminal triad of spikelets on each panicle branch but Roberty (1954: 403; 1960: 290) reported the presence of up to 4 diads beneath it. I have seen a few such specimens in Johor, Kuala Lumpur, and Selangor, with a diad underneath the triad of the lowermost branch (for instance *Veldkamp* 8757, L). The anthers of the sessile spikelet are distinctly smaller than those of the pedicelled ones and occasionally appear to be staminodial, rendering the floret functionally female. The leaves of this species are usually rather short, those of the culms being reduced to small leaf blades. On young shoots long leaves may occur which led to the name *C. aciculatus* var. *longifolius* Buse for such plants.

2. *Chrysopogon borneensis* Henr., Blumea 4 (1941) 534. **Type:** *Endert* 5271 (holo: L; iso: BO).

Perennials. Culms 0.25–0.5 m tall. Ligule c. 0.3 mm

long. Leaf blades conduplicate, 4–10 cm by 1.2–3.5 mm, adaxially glabrous, with margins pilose at base. Panicle 3–4 by c. 1.5 cm in outline, with few branches and spikelets, pale yellow; lowermost branches whorled, with longest branch simple, c. 3 cm long. Raceme peduncles c. 2.5 cm long, smooth and puberulous at base, with a terminal triad. Sessile spikelets 6.35–6.5 mm long (incl. callus), callus oblique, pungent, 0.9–1.35 mm long, setose, with hairs 1.2–1.3 mm long, golden. Lower glume smooth, setulose, with apex acute. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 1–4.5 mm long. Second lemma awned, the awn exserted, geniculate with contorted column and straight arista, 11–20 mm long, with column puberulous, with hairs c. 0.1 mm long. Anthers 3, 2–2.2 mm long. Pedicel 2.25–3.5 mm long, slightly less to more than half as long as the sessile spikelet, setose on the edges, with hairs 1.8–1.9 mm long. Pedicelled spikelets with 1 male floret, 4.65–5.25 mm long. Lower glume smooth, setulose, mucronate, with mucro 0.4–3 mm long. Upper glume muticous to mucronate, with mucro 0–0.4 mm long. Anthers 1.8–2 mm long.

Distribution and habitat: E Borneo (Kutai). Limestone rock in low, open forest; at 100 to 200 m altitude.

Notes: *Chrysopogon borneensis* is very similar to *C. tenuiculmis*, differing from that, as far as can be told from the only specimen seen, by the following characters:

-. Lowermost longest branch of the panicle c. 3 cm long. Raceme peduncles c. 2.5 cm long. Sessile spikelets with callus hairs 1.2–1.3 mm long. Pedicelled spikelets with anthers 1.8–2 mm long. Pedicel setose on the edges.
.....*Chrysopogon borneensis*

-. Lowermost longest branch of the panicle 1.4–2.5 cm long. Raceme peduncles 0.8–1.5 cm long. Sessile spikelets with callus hairs 1.9–2.55 mm long. Pedicelled spikelets with anthers 2.1–2.8 mm long. Pedicel glabrous, smooth.
.....*Chrysopogon tenuiculmis*

3. *Chrysopogon celebicus* Veldk., sp. nov. A *Chrysopogon* is specibus asiaticis in culmis 0.6–1 m altis, paniculis 7–12 cm

longis 0.6–2 cm latis pallide flavidis, spiculae sessilis callo rotundato ad oblique obtuso 0.6–0.75 mm longo pilis albis, glumae superioris mucrone 0.45–1.85 mm longo, lemmatis secundi arista 3.75–9 mm longa, spiculis pedicellatis 1.95–4.5 mm longis differt. **Typus:** *Meijer* 9189 (holo: L; iso: A, BO, KY, MO, US).

Perennials. Culms 0.6–1 m tall. Ligule 0.15–0.5 mm long. Leaf blades conduplicate, 16.5–85 cm by 4–12 mm, adaxially glabrous to sparsely pilose. Panicle axillary and terminal, 7–12 by 0.6–2 cm in outline, with many branches and spikelets, pale yellow; lowermost branches solitary to whorled, with longest branch simple to branched at base, branch 3–5.7 cm long. Raceme peduncles 1.5–2 cm long, scaberulous, with 4–7 spikelet groups per branch, joints 2.7–7.5 mm long, glabrous to distally setulose. Sessile spikelets 4–4.85 mm long (incl. callus), callus rounded to oblique, obtuse, 0.6–0.75 mm long, setose, with hairs 1.5–3.5 mm long, white. Lower glume spinulose, distally pilulose to setulose, with apex acute to minutely bidentate, with mucro 0–0.15 mm long. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 0.45–1.85 mm long. Second lemma awned, the awn exserted, straight to geniculate with contorted column and straight arista, 3.75–9 mm long, with column glabrous to puberulous, with hairs 0–0.05 mm long. Anthers 3, 1.35–2.15 mm long. Pedicel 2.4–4.1 mm long, more than half as long as the sessile spikelet, glabrous, smooth. Pedicelled spikelets with 1 male floret or reduced to only 2 glumes, 1.95–4.5 mm long. Lower glume smooth, distally setulose, muticous. Upper glume muticous. Anthers 3.15–3.75 mm long.

Distribution, habitat and ecology: Celebes (Palu and G. Tambusisi). Grassy hills on sandy soil, along stream, locally in groups; at 0 to 300 m altitude.

Notes: By the 4–7 spikelet groups and the rounded to slightly oblique callus of the sessile spikelet it is most similar to the species formerly included in *Vetiveria* s.s., but it has the long callus hairs, long, geniculate awn, and puberulous column of a *Chrysopogon* s.s. species. It is similar to *C. lawsonii* and *C.*

nemoralis, but differs as follows:

-. Sessile spikelets upper glume mucro 0.45–1.85 mm long. Sessile spikelets second lemma awn 3.75–9 mm long. Pedicelled spikelets 1.95–4.5 mm long.....*Chrysopogon celebicus*

-. Sessile spikelets upper glume mucro 3.75–12.7 mm long. Sessile spikelets second lemma awn 18–29 mm long. Pedicelled spikelets 6–7.8 mm long.....*Chrysopogon lawsonii*

-. Spikelet groups 4–7 per branch. Sessile spikelets 4–4.85 mm long (incl. callus), callus rounded to oblique, obtuse, 0.6–0.75 mm long. Awn 3.75–9 mm long....*Chrysopogon celebicus*

-. Spikelet groups 1–3 per branch. Sessile spikelets 5.6–8.25 mm long (incl. callus), callus oblique, pungent, 1.2–1.7 mm long. Awn 13–22 mm long.....*Chrysopogon nemoralis*

4. *Chrysopogon festucoides* (Presl) Veldk., **comb. nov.**; *Andropogon festucoides* Presl, Rel. Haenk. 1 (1830) 340; *Vetiveria festucoides* (Presl) Ohwi, Bull. Tokyo Sc. Mus. 18 (1947) 4. **Type:** *Haenke* s.n. (holo: PR; iso: W no. 257377, neg. 1220; s.n., neg. 1221).

Andropogon anias Llanos, Fragm. Pl. Filip. (1851) 29. **Type:** not extant. Neotype: Merrill Sp. Blanc. (*J.K. Santos*) 389 (holo: US; iso: A, BM, BO, K, L, MO, NSW, NY, P, here designated), probably the same as BS 22238 (*J.K. Santos*) (K, L) which was collected on the same date in the same place and so seems a double-numbered gathering.

Andropogon muricatus var. *aristatus* Buse in De Vriese, Pl. Ind. Bat. Or. (1856) 104. **Type:** *Kleinhoff* s.n. in Hb. Reinwardt (holo: L no. 903.342-379).

[*Andropogon squarrosus* auct. non L.f.]

[*Andropogon squarrosus* var. *nigritanus* auct. non Hack.]

[*Andropogon zizanioides* auct. non Urban.]

[*Chrysopogon zizanioides* var. *nigritanus* auct. non Roberty.]

Vetiveria lawsonii auct. non Blatter & McCann (See note).]

[*Vetiveria nigritana* auct. non Stapf.]

Perennials. Culms 1.5–2.5 m tall. Ligule 0.45–1.3 mm long. Leaf blades conduplicate, 17–74 cm by 4–13 mm, adaxially glabrous to pilose in the lower part. Panicle 15–27 by 3.5–6 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple, 6–9.5 cm long. Raceme peduncles 0.6–3.5 cm long, scaberulous, with 8–13 spikelet groups per branch, joints 4.1–9.2 mm long, glabrous to setulose. Sessile spikelets 4.1–5.4 mm long (incl. callus), callus rounded, 0.75–1.1 mm long, laterally ciliate at base, especially near the base of the pedicel, with hairs 0.4–1.5 mm long, white to golden. Lower glume spinulose, aculeate, especially on the nerves and setulose, with apex acute. Upper glume aculeate, especially on the midrib and midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 0.2–1.5 mm long. Second lemma awned, the awn exserted, straight, 2.5–5.25 mm long, with column glabrous. Anthers 3, 1.5–2.1 mm long. Pedicel 2.25–3.15 mm long, more than half as long as the sessile spikelet, scaberulous. Pedicelled spikelets with 1 male or sterile floret, 3.75–5.25 mm long. Lower glume scaberulous, aculeate, especially on the nerves, muticous. Upper glume muticous. Anthers 1.5–2.2 mm long.

Distribution and habitat: India (Assam), Upper Burma (Myitkyina), Thailand (Central: Ang Thong; Bangkok; Chaimat, Manorom), S. Laos, Vietnam (Dac Lac, ? Dongthap, see note), Malesia [Sumatra, E. Coast, Tomah Rajah, Java (Jakarta; Kangean Isl.); Philippines (Luzon: Pampanga, Nueva Ecija Provinces)]. Level land, rice fields on humid to swampy soil, *Miscanthus* grassland, locally dominant; at 0 to 500 m altitude.

Uses: None recorded; the roots are odourless [Merrill, Sp. Blanc. (1918) 61–62; Enum. Philip. Fl. Pl. 1 (1923) 44]. Very unpalatable to stock (Hacker 1559).

Notes: *Chrysopogon festucoides* is morphologically very close to *C. zizanioides*,

differing mainly from it by the mucronate upper glume of the sessile spikelet and the exerted awn. The collection from Upper Assam by Jenkins in Hb. Hooker (K) belongs to this species. *Belcher* 855 (A, US) is the only record for Upper Burma. Four collections of this species from Central Thailand have been seen in K: *Kerr* 7852, Bangkok, 19669, Chaimat, Manorum, and *Sørensen* et al. 2105, 71 km N of Bangkok. From this region, there is also *Put* 2593, Ang Thong, which has the long anthers of *C. nigrimana*, but which, because of the provenance, is included here. At least part of A. Camus' *V. zizanioides* var. *genuina* from S. Laos (Thorel s.n., Lu Khou; P) also belongs here.

It might be that the plant from Vietnam (Dongthap) depicted by Ho [Cayco Vietnam 3/ 2 (1993) 879 as *V. lawsonii* (Hook. f.) Blatter & McCann] belongs here. I have seen a collection from Dac Lac Prov. (M'Drak, *Hacker* 1559, L; BRI, n.v.), it has glabrous nodes.

Chrysopogon nigrimanus is very similar and has been confused with it. The two differ mainly in:

-. Sessile spikelets anthers 1.5–2.1 mm long, of the pedicelled spikelets 1.5–2.1 mm long. SE Asia.....*Chrysopogon festuoides*

-. Sessile spikelets anthers 2.5–2.85 mm long, of the pedicelled spikelets 2.5–3 mm long. Africa.....*Chrysopogon nigrimanus*

5. *Chrysopogon filipes* (Benth.) Reeder, J. Arn. Arb. 29 (1948) 360; *Chrysopogon elongatus* var. *filipes* Benth., Fl. Austr. 7 (1878) 539; *Andropogon elongatus* var. *filipes* Hack., Mon. Androp. (1889) 565; *Vetiveria filipes* C.E. Hubb., Kew Bull. (1934) 444; *Rhaphis elongatus* var. *filipes* Keng, Sinensia 10 (1939) 314, nom. inval. **Lectotype:** *Mitchell* s.n. (holo: K, holo, photo in BRI; iso: MEL; here proposed).

Chrysopogon filipes var. *arundinaceus* Reeder, J. Arn. Arb. 29 (1948) 360; *Vetiveria filipes* var. *arundinacea* Jansen, Acta Bot. Neerl. 2 (1953) 386. **Type:** *Brass* 8460 (holo: A; iso: BRI, L, US).

Perennials. Culms 0.7–1.5 m tall. Ligule 0.2–0.75 mm long. Leaf blades conduplicate, 20–67 cm by 3–8 mm, adaxially glabrous to pilose in the lower part. Panicle 15–30 by 3–6 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple, 6–13.5 cm long. Raceme peduncles 1.3–8 cm long, scaberulous, with (1–)3–7 spikelet groups per branch, joints 5–16(–20) mm long. Sessile spikelets 8–10.6 mm long (incl. callus), callus oblique, pungent, 2–4 mm long, setose, with hairs 0.75–2.25 mm long, golden. Lower glume spinulose, aculeate, especially on the nerves and setulose, with apex bi-dentate, with mucro 0–0.7 mm long. Upper glume aculeate, especially on the midrib and midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 1.5–6 mm long. Second lemma awned, the awn exerted, straight, 10–35 mm long, with column puberulous, with hairs 0.1–0.15 mm long. Anthers 3, (1.9–)2.25–3.9 mm long. Pedicel 3.75–8 mm long, more than half as long as the sessile spikelet, glabrous, smooth to scaberulous. Pedicelled spikelets with 1 male floret or reduced to only 1 glume, 1.1–8.6 mm long. Lower glume smooth, setulose, mucous. Upper glume mucous. Anthers (1.9–)2.25–3.9 mm long.

Distribution, habitat and ecology: Australia (N. Territory to N.S. Wales), Malaysia (Papua New Guinea: Western Province). Savannah (Eucalypt) forest on alluvial flat of creek, wet gully in savanna grassland, locally common; at 0 to 30 m altitude.

Vernacular name: Australian vetiver (E.).

Uses: Readily eaten by stock.

Notes: Reeder (and Jansen) distinguished a var. *arundinacea*. Now that more material is available, this falls within the range of variability of the Australian forms and hence is not worth recognizing formally.

Most similar to *C. filipes* are *C. oliganthus* and *C. sylvaticus*, also from Australia, which may be distinguished as follows:

-. Raceme peduncles scaberulous. Sessile spikelets 8–10.6 mm long (incl. callus), lower glume aculeate, especially on the nerves and

setulose, upper glume mucro 1.5–6 mm long, anthers 2.25–3.9 mm long. *Chrysopogon filipes*

-. Raceme peduncles smooth. Sessile spikelets 4.5–7.65 mm long (incl. callus), lower glume glabrous to distally pilulose, upper glume mucro 0–0.4 mm long, anthers 1.05–1.2 mm long. *Chrysopogon oliganthus*

-. Sessile spikelets 8–10.6 mm long (incl. callus), lower glume aculeate, especially on the nerves and setulose, the awn straight. Pedicelled spikelets lower glume smooth *Chrysopogon filipes*

-. Sessile spikelets 6–7.5 mm long (incl. callus), lower glume glabrous to distally pilulose, the awn geniculate with contorted column and straight arista. Pedicelled spikelets lower glume scaberulous..... *Chrysopogon sylvaticus*

For the differences with *C. micrantherus*, see there.

6. *Chrysopogon fulvus* (Spreng.) Chiov., Fl. Somala 1 (1929) 327; *Pollinia fulva* Spreng., Pl. Min. Cog. Pug. 2 (1815) 10, comb. incorr.; *Andropogon sprengelii* Kunth, Rev. Gram. 1 (1829) 166, non *A. fulvus* Spreng. (1815). **Type:** 'Bengal' (Hb. Trinius 337.01, LE, left satchel, iso, IDC microfiche BT-16/1).

Chrysopogon montanus Trin. in Spreng., Neue Entd. 2 (1821) 93; *Andropogon monticola* Schult. & Schult.f., Mant. 3 (1827) 665, non *A. montanum* Roxb. (1820); *Chrysopogon monticola* (Schult. & Schult.f.) Haines, Ind. For. 40 (1914) 495, nom. superfl.; *Andropogon monticola* var. *genuinus* Hack., Mon. Androp. (1889) 558, nom. inval.; *Chrysopogon fulvus* subvar. *montanus* (Trin.) Roberty, Boissiera 9 (1960) 283, 287, nom. inval. **Type:** *Koenig* s.n. ex Hb. Banks in Hb. Jacquini (holo: W; iso: BM; Hb. Trinius 337.01, upper right satchel and left hand drawing, LE, iso, IDC microfiche BT-16/1).

Perennials. Culms 0.2–1.2 m tall. Ligule 0.2–0.5 mm long. Leaf blades flat, 15–30 cm by 2–3(–9) mm, adaxially glabrous to puberulous, with the

margin pectinate in the lower part. Panicle 4–11(–15) by 1.5–3 cm in outline, with many branches and spikelets, pale yellow; lowermost branches whorled, with longest branch simple, 3–7 cm long. Raceme peduncles 2–6 cm long, puberulous, with a terminal triad, rarely with 2 spikelet groups per branch, joints 1–2 mm long, setose. Sessile spikelets 3.5–6.5(–8) mm long (incl. callus), callus oblique, pungent, 0.75–1.5 mm long, setose, with hairs 1.5–1.9 mm long, golden. Lower glume smooth, distally pilulose, with apex acute. Upper glume with midrib distally setulose, with a dorsal fringe of hairs, with apex mucronate, with mucro 6–20 mm long. Second lemma awned, the awn exerted, geniculate with contorted column and straight arista, 12–40 mm long, with column puberulous, with hairs 0.2–0.4 mm long. Anthers 3, 2–4.5 mm long. Pedicel 1–2.5 mm long, much less than half as long as the sessile spikelet, setose on the edges, with hairs 3–4.9 mm long. Pedicelled spikelets with 1 male floret, 2.5–8 mm long. Lower glume smooth, puberulous, mucicous to mucronate, with mucro 0–7 mm long. Upper glume mucicous. Anthers 3.15–4.5 mm long. $2n = 20, 80$.

Distribution, habitat and ecology: Sri Lanka, S India to NW (Tak) and SW Thailand (Kanchanaburi). Roadsides, grasslands, open dry deciduous forest, locally vegetation-forming; at 0 to 300 m altitude.

Uses: Fodder and hay, used in soil erosion control.

Notes: I do not think that *Chrysopogon montanus* is homotypic with *Pollinia fulva* even though material of both is present on the same sheet in the Trinius herbarium. In the original publication no reference was made to *P. fulva*, and the specimen was said to be in Jacquini's herbarium, not Sprengel's. I think the specimens came together after 1821 when Trinius realized they were conspecific: in Acta Acad. Imp. Sc. Petersb. VI, 2 (1832) 318 (top!) *P. fulva* is cited as a synonym of *C. montanus*. It should of course have been the other way around.

C. fulvus is most similar to *C. orientalis* and *C. serrulatus*. It can be distinguished from *C. orientalis* as follows:

-. Panicle pale yellow. Sessile spikelets upper glume with a dorsal tuft of hairs. Pedicel much less than half as long as the sessile spikelet.*Chrysopogon fulvus*

-. Panicle purplish. Sessile spikelets upper glume without a dorsal tuft of hairs. Pedicel slightly less than half as long as the sessile spikelet.*Chrysopogon orientalis*

It can be distinguished from *C. serrulatus* as follows:

-. Panicle pale yellow. Sessile spikelets upper glume with a dorsal tuft of hairs, column hairs 0.2–0.4 mm long. Pedicel hairs 3–4.9 mm long.*Chrysopogon fulvus*

-. Panicle purplish. Sessile spikelets upper glume without a dorsal tuft of hairs, column hairs 0.1–0.15 mm long. Pedicel hairs 1.2–2.1 mm long.*Chrysopogon serrulatus*

7. *Chrysopogon intercedens* Veldk., sp. nov. A *Chrysopogonis* speciebus asiaticis paniculae ramulis infimis verticillatis, ramo longissimo c. 4.8 cm longo, racemi pedunculo c. 3 cm longo laevi, spiculis sessilibus 6.6–7.1 mm longis (callus incl.), calli pilis albis, gluma inferiore aculeata ad setulosa, arista 15–16 mm longa, columna puberula pilis c. 0.2 mm longis, spiculis pedicellatis 5.4–6.4 mm longis differt. *Chrysopogone oligantho* proximus, qui in calli pilis aureis, spiculae sessilis glumae superioris mucrone fere absenti (0–0.4 mm longo) antheribus brevioribus (1.05–1.2 mm longis) differt. **Typus:** NGF 49350 (*Henty & Foreman*) (holo: L; iso: LAE, n.v.).

Perennials. Culms c. 1.8 m tall. Ligule c. 0.4 mm long. Leaf blades conduplicate, 60 cm or more by 5–6 mm, adaxially glabrous to pilose. Panicle c. 19 by 2 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple, c. 4.8 cm long. Raceme peduncles c. 3 cm long, smooth, with 2 or 3 spikelet groups per branch, joints 5.6–12 mm long, setulose. Sessile spikelets 6.6–7.1 mm long (incl. callus), callus oblique, pungent, 1.5–1.7 mm long, setose, with hairs 1.2–1.6 mm long, white. Lower glume spinulose,

aculeate, especially on the nerves and setulose, with apex acute to minutely bidentate. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 1.6–3 mm long. Second lemma awned, the awn exerted, straight, 15–16 mm long, with column puberulous, with hairs c. 0.2 mm long. Anthers 3, 1.3–1.5 mm long (immature?). Pedicel 4.1–4.5 mm long, more than half as long as the sessile spikelet, glabrous, smooth to slightly scaberulous. Pedicelled spikelets with 1 male to sterile floret, 5.4–6.4 mm long. Lower glume smooth, setulose, mucous. Upper glume mucous. Anthers c. 2.85 mm long.

Distribution and habitat: Papua New Guinea (Western Province). Savanna woodland; at c. 15 m altitude.

Notes: This species seems morphologically intermediate between *C. oliganthus* and *C. filipes*. It appears to be sympatric with the latter and might be a hybrid, were it not that the first is not yet known from New Guinea. This might explain the possibly staminodial nature of the anthers of the sessile spikelet, which coupled to a reduced fertility of the sessile spikelets, where anthers appear to be absent in some of these, would make fertilization difficult.

Chrysopogon intercedens is most similar to *C. oliganthus*, but can be distinguished as follows:

-. Sessile spikelets callus hairs white, upper glume mucro 1.6–3 mm long, anthers 1.3–1.5 mm long.*Chrysopogon intercedens*

-. Sessile spikelets callus hairs yellow, upper glume mucro 0–0.4 mm long, anthers 1.05–1.2 mm long.*Chrysopogon oliganthus*

8. *Chrysopogon lawsonii* (Hook.f.) Veldk., comb. nov.; [*Chrysopogon lawsonii* (Hook.f.) Roberty, Boissiera 9 (1960) 290 (cited as ‘nomen superfluum’, hence invalid).] *Andropogon lawsonii* Hook.f., Fl. Br. Ind. 7 (1896) 187 (‘lawsoni’). *Vetiveria lawsonii* (Hook.f.) Blatter & McCann, J. Bomb. Nat. Hist. Soc. 32 (1928) 409. **Type:** *Lawson* 28 (holo: K).

Perennials. Culms 0.45–1.7 m tall. Ligule 0.15–0.3 mm long. Leaf blades flat to conduplicate,

5–23(–45) cm by 3–5 mm, adaxially glabrous, or with a few bristles, abaxially with midrib and margins pectinately setulose. Panicle 10–30 by 1–3 cm in outline, with many branches and spikelets, pale yellow to pale reddish; lowermost branches whorled to solitary, with longest branch simple to branched, 5–8 cm long. Raceme peduncles 1.5–5 cm long, smooth to slightly scaberulous, with 2–8 spikelet groups per branch, joints 1.75–7.5 mm long, glabrous. Sessile spikelets 4–6.2 mm long (incl. callus), callus oblique, obtuse, (0.5–)1.05–1.5 mm long, setose, with hairs 0.8–1.5 mm long, white. Lower glume spinulose, glabrous and distally pilulose, with apex acute to minutely bi-dentate. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 3.75–12.7 mm long. Second lemma awned, the awn exserted, geniculate with contorted column and straight arista, (14–)18–29 mm long, with column puberulous, with hairs 0.1 mm long. Anthers 3, 2–3.25 mm long. Pedicel (3–)3.7–4.1 mm long, more than half as long as the sessile spikelet, glabrous, smooth. Pedicelled spikelets with 1 male floret, 6–7.8 mm long. Lower glume smooth, setulose, usually mucronate sometimes mucicous, with mucro (0–)2–6 mm long. Upper glume mucicous to mucronate, mucro 0–1.5 mm long. Anthers 2–3.7 mm long. $2n = 20$ (36?).

Distribution, habitat and ecology: S India (S Maharashtra, S Karnataka, NW Andhra Pradesh, Tamil Nadu: Nilgiris), Thailand (N: Chiangmai, Doi Inthanon). Note the disjunction. Moist soil, banks of waterways, sandy localities, locally abundant; at 550 to 1200 m altitude.

Uses: Cattle are said to eat the leaves, but avoiding the flowering culms.

Notes: This species is morphologically intermediate between *Chrysopogon* and *Vetiveria* in that its sessile spikelet has the oblique hairy callus and puberulous columns as in the former, and the racemes with 2–8 groups of spikelets as in the latter. The single Thai collection seen by me (Phengkhai & Smitinand 6085, K) is indistinguishable from the Indian material I have seen, except for its shorter awns (14–17 vs. 18–29 mm long) and

pedicels (3–3.75 vs. 3.7–4.1 mm long). Ho [Cayco Vietnam 3/2 (1993) 879] recorded and depicted a species under this name for Vietnam. However, the plate appears to be of *C. festucoides* Presl, except that the nodes and leaf throat are depicted as pilose, something I have not observed in any species of *Chrysopogon* so far.

9. *Chrysopogon micrantherus* Veldk., sp. nov.

A *Chrysopogonis* omnibus speciebus asiaticis culmis 1.65–2 m vel ultra altis, foliis 50–100 cm longis, paniculis 19–27 cm longis purpurascens, racemi pedunculo 4–4.5 cm longo scaberulo, spiculis sessilibus 5.3–6.3 mm longis, callo obliquo pungenti incluso, pilis 1.8–3.6 mm longis albis, gluma inferiore setulosa, glumae superioris mucrone 0.4–3.45 mm longo, lemmatis secundi arista geniculata columna contorta puberula, subula stricta, antheris 0.6–1 mm longis, pedicello 2.25–3.4 mm longo, spiculis pedicellatis setulosis differt. **Typus:** Brass 8579 (L, holo; A, BRI, US).

[*Chrysopogon elongatus* auct. non Benth.]

[*Rhaphis elongatus* auct. non Chase.]

[*Vetiveria elongata* auct. non C.E. Hubb.]

[*Vetiveria filipes* auct. non C.E. Hubb.]

Perennials. Culms 1.65–2 m tall or more. Ligule 0.2–0.45 mm long. Leaf blades conduplicate, 50–100 cm by 3.5–11 mm, adaxially glabrous to pilose. Panicle 19–27 by 2–4.5 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple, sometimes branched, 6.5–7.5 cm long. Raceme peduncles 4–4.5 cm long, scaberulous, with (1 or) 2 or 3 spikelet groups per branch, joints 4.9–8 mm long, glabrous. Sessile spikelets 5.3–6.3 mm long (incl. callus), callus oblique, pungent, 1.2–2.25 mm long, setose, with hairs 1.8–3.6 mm long, white. Lower glume spinulose to smooth, setulose, with apex acute to minutely bi-dentate, with mucro 0–0.25 mm long. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 0.4–1.8(–3.45) mm long. Second lemma awned, the awn exserted,

geniculate with contorted column and straight arista, 5.25–14 mm long, with column puberulous, with hairs c. 0.1 mm long. Anthers 3, 0.6–1 mm long. Pedicel 2.25–3.4 mm long, more than half as long as the sessile spikelet, glabrous, smooth. Pedicelled spikelets with 1 male or sterile floret, 5.7–7.85 mm long. Lower glume smooth, setulose, muticous. Upper glume muticous. Anthers 2.8–4.05 mm long (if present).

Distribution, habitat and ecology: Papua New Guinea (Western Province). Heavy wet soil behind mangrove, along swamp margins; at low altitude. Locally vegetation-forming.

Notes: The epithet refers to the small anthers of the sessile spikelets.

Chrysopogon filipes seems most similar to *C. micrantherus* but can be distinguished as follows:

-. Culms 0.7–1.5 m tall. Sessile spikelets 8–10.6 mm long (incl. callus), callus hairs golden, the awn straight, anthers 2.25–3.9 mm long. Pedicel 3.75–8 mm long.....*Chrysopogon filipes*

-. Culms 1.65–2, or more m tall. Sessile spikelets 5.3–6.3 mm long (incl. callus), callus hairs white, the awn geniculate with contorted column and straight arista, anthers 0.6–1 mm long. Pedicel 2.25–3.4 mm long....*Chrysopogon micrantherus*

10. *Chrysopogon nemoralis* (Balansa) Holtt., Gard. Bull. Singapore 11 (1947) 297; *Andropogon nemoralis* Balansa in Morot, J. Bot. 4 (1890) 113; *Vetiveria nemoralis* (Balansa) A. Camus, Fl. Gen. I.-C. 7 (1922) 329. **Type:** *Balansa* s.n. (holo: Lno. 908.83-373; iso: P).

Andropogon gryllus var. *philippinensis* Merr., Philip. J. Sc., Bot. 14 (1919) 368. *Chrysopogon philippinensis* (Merr.) Henr., Blumea 4 (1941) 532; **Type:** BS 30964 (*Ramos & Edano*) (holo: PNH, lost; iso: BO, K, L).

NB. BS 30964 (*Ramos & Edano*) is the correct citation as used in Flora Malesiana literature, an alternative sometimes found is *Ramos & Edano* BS 30964. *Ramos & Edano* [BS 30964] is

certainly wrong. I've had a long discussion about this with Ben Stone when he was devising the format for the Flora of the Philippines Inventory Report.

[*Chrysopogon gryllus* auct. non Trin.]

[*Vetiveria lawsonii* auct. non Blatter & McCann]

Perennials. Culms 0.4–0.9 m tall. Ligule 0.2–0.4 mm long. Leaf blades flat to conduplicate, 6–30 cm by 2.25–8 mm, adaxially glabrous. Panicle 9–15 by 1–2.5 cm in outline, with many branches and spikelets, pale yellow to purplish; lowermost branches solitary to paired, upwards a few together in whorls, with longest branch simple to branched at base, 2–3.5 cm long. Raceme peduncles 0.6–1.5 cm long, smooth to scaberulous, with 1–3 spikelet groups per branch, joints 4.5–10 mm long, glabrous to distally setulose. Sessile spikelets 5.6–8.25 mm long (incl. callus), callus oblique, pungent, 1.2–1.7 mm long, setose, with hairs 1.1–1.75 mm long, golden. Lower glume spinulose to smooth, setulose to aculeate, especially on the nerves, with apex acute to bidentate and mucronate, with mucro 0–0.8 mm long. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 0.75–5.25 mm long. Second lemma awned, the awn exerted, straight, 13–22 mm long, with column puberulous, with hairs 0.05–0.1 mm long. Anthers 3, 1.4–1.7 mm long. Pedicel 2.25–6.4 mm long, more than half as long as the sessile spikelet, glabrous, smooth to apically setose, hairs 0–0.7 mm long. 1-pedicelled spikelet with 1 sterile floret, or reduced to only 2 glumes, 3.2–6 mm long. Lower glume smooth, distally setulose, muticous to mucronate, with mucro 0.7–0.9 mm long. Upper glume muticous.

Distribution, habitat and ecology: ? Thailand (see note) to Indo-China, Malesia (Malay Pen: Pahang, Sungei Tahan; Trengganu, Kemaman; Philippines: Panay). Note the disjunctions. Among river boulders; at up to c. 180 m altitude. Apparently very rare and local everywhere.

Notes: Chinapan et al. and several other authors [Abstr. Int. Conf. to commemorate the 50th anniversary...of...the King of Thailand (1996) e.g. pp. 24, 27, 32, 43, 142] suggest that

C. nemoralis might be useful for hedges against erosion, similar to the use of *C. zizanioides*. These authors state that the species would be wide-spread in Thailand. It is therefore curious to note that there are no Thai collections of *C. nemoralis* in A, AAU, BKF, BM, BO, C, L, MO, NY, P, SING, SINU and US while it is not mentioned in the lists of Thai grasses by Bor (1962, 1965). The Thai vernacular names (‘fek deng’, ‘fek kao’, ‘ya fak’) refer to tall, robust, clumped grasses, so that several species perhaps not even belonging to *Chrysopogon* are possibly grown under this scientific name. The only specimen seen identified as *C. nemoralis*, said to be of the Ratchaburi race, was of *C. zizanioides*.

Chrysopogon nemoralis is apparently very rare and local; I have only seen 6 collections: the type of its name and Eberhardt 2216 [P, K (neg. 5002)], both from Vietnam, 3 collections from the Malay Peninsula, and the type of *C. philippinensis* from Panay. The Pahang material seen in SING (Ridley 2137, SF 20825) differs slightly from the Vietnamese, with the Kemaman collection [SF 25846 (*Corner*); also in SING] being somewhat morphologically intermediate.

	Vietnam	Malay Pen. (Pahang)
joints (mm)	7.5–10	4.3–6.75
callus (mm)	1.2–1.5	1.9–2.25
mucro of the upper glume of the sessile spikelet (mm)	0.75–1.65	2.6–5.25
pedicelled spikelet with	1 sterile fl.	2 glumes only

The Philippines material is also slightly different:

	Vietnam	Philippines
sessile spikelets	5.6–7.5	7.5–8.25 mm long
callus	1.2–1.5	1.6–1.7 mm long
pedicel hairs	absent	present, 0.2–0.7 mm long

11. *Chrysopogon orientalis* (Desv.) A. Camus, Fl. Gen. I.-C. 5 (1925) 332; [*Andropogon gryllus* auct. non L.: Rottler, Neue Schr. Ges. Naturf. Fr. Berlin 4 (1803) 207; Willd., Sp. Pl. ed. 4, 4, 2 (1806) 69, pro specim. Ind. Or.]; *Rhaphis orientalis* Desv., Opusc. (1831) 69.; *Chrysopogon verticillatus* var. *orientalis* (Desv.) Roberty, Boissiera 9 (1960) 283, 285. nom.inval. **Type:** *Klein* 392 in Hb. Willdenow 18636 (sheet 4) (holo: B, IDC microfiche 7440).

Andropogon breviaristatus Steud., Syn. 1 (1854) 396 (‘*breviaristatus*’), 436; *Andropogon aristulatus* Hochst. ex Hack., Mon. Androp. (1889) 556, nomen superfl. **Type:** *Hohenacker* 1285 (holo: P; iso: L).

Andropogon wightianus Nees ex Steud., Syn. 1 (1854) 395; *Chrysopogon wightianus* (Nees ex Steud.) [Nees ex Wight, Cat. (1834) 98, nomen] Thw., Enum. Pl. Zeyl. (1864) 366. **Lectotype:** Hb. Wight 1676 (‘1675’ in Roberty; holo: P; iso: K, LE (Hb. Trin. 339.1 as Wight 355 ex Hb. Kunth, IDC microfiche BT-16/1; here proposed).

Chrysopogon sinensis Rendle, J. Lin. Soc. Bot. 36 (1904) 368 - **Lectotype:** *Sampson* in Hb. Hance 3453 (holo: BM; iso: US), here designated.

Chrysopogon collinus Ridl., J. Str. Br. Roy. As. Soc. 82 (1920) 203. **Type:** SF 649 (*Haniff*) (holo: SING; iso: K).

Perennials. Culms 0.65–1.1 m tall. Ligule 0.2–0.75 mm long. Leaf blades flat to conduplicate, 3–33 cm by 2–6 mm, adaxially glabrous to puberulous. Panicle 7.5–20 by 1–3 cm in outline, with many branches and spikelets, purplish; lowermost branches solitary to whorled, with longest branch simple, 3.5–6 cm long. Raceme peduncles 2.3–4.5 cm long, smooth to puberulous, with a terminal triad. Sessile spikelets 6.15–10.3 mm long (incl. callus), callus oblique, pungent, 1–4.3 mm long, setose, with hairs 1.7–2.85 mm long, golden. Lower glume smooth, glabrous or distally pilulose, with apex obtuse, rarely bi-dentate and bi-

mucronate, with mucro 0–9 mm long. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 8–17 mm long. Second lemma awned, the awn exserted, geniculate with contorted column and straight arista, 30–60 mm long, with column puberulous, with hairs 0.2–0.9 mm long. Anthers 3, 2.6–3.75 mm long. Pedicel 2.25–4(–5) mm long, slightly less than half as to more than half as long as the sessile spikelet, setose on the edges, with hairs 1–4.3 mm long. Pedicelled spikelets with 1 male floret to reduced to only 2 glumes, 5.6–8.5 mm long. Lower glume smooth, glabrous to puberulous, rarely mucinous to mucronate, with mucro (0–)5.6–15 mm long. Upper glume mucinous to mucronate, with mucro 0–6.75 mm long. Anthers 3.15–3.75(–4.1) mm long. $2n = 20$.

Distribution, habitat and ecology: Sri Lanka, S India (Tamil Nadu), Burma to S China (Hainan, Fujian), Thailand (NE: Sakon Nakhon; Central: (Bangkok); E: Nakhon Ratchasima; SW: Kanchanaburi, Phetchaburi, Ratchaburi, Prachuap Khiri Khan; Peninsular: Nakhon Si Thammarat, Narathiwat, Phuket, Satun, Songkhla, Trang; SE: Chon Buri); Malesia (Malay Pen.: Kelantan, Langkawi, Pahang, Trengganu, Sumatra: Padang). Meadows and roads on limestone and coastal sandy areas, open deciduous forest, trampling and fire resistant; at low altitude.

Uses: Grazed by cattle; recommended for very poor soil.

Notes: Gilliland [Rev. Fl. Mal. 3 (1971) 237] has included *C. collinus* in *C. fulvus* (Spreng.) Chiov., but the isotype of that name in K (from Setul, now S Thailand) clearly belongs here. For the differences between *C. orientalis* and *C. fulvus* see under *C. fulvus*. Occasionally the lower glume of the sessile spikelet has a bi-aristate apex, for instance in *Kerr* 10721 (BK, fide C. Hambananda msc) and *Niyomdham & Ueachirakan* 1926 (L) from Thailand. These are also occasionally present in *C. tenuiculmis*.

12. *Chrysopogon perlaxus* Bor, Dansk Bot. Ark. 23 (1965) 157. **Type:** Larsen 8015 (holo: K; iso: C).

Perennials. Culms more than 1.15 m tall. Ligule 0.6–1.1 mm long. Leaf blades flat, 13.5–25 cm by 4–8 mm, adaxially puberulous, with margins pectinate in lower part. Panicle 11–15 by 4–6 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple, 6–9 cm long. Raceme peduncles 5–8 cm long, smooth to scaberulous, with a terminal triad. Sessile spikelets 7–8.25 mm long (incl. callus), callus oblique, pungent, c. 1.5 mm long, setose, with hairs 1.5–2.25 mm long, golden. Lower glume smooth, glabrous, with apex acute or minutely bi-dentate. Upper glume with midrib distally setulose, with a dorsal fringe of hairs, with apex mucronate, with mucro 6.5–10.5 mm long. Second lemma awned, the awn exserted, geniculate with contorted column and straight arista, 30–33 mm long, with column puberulous, 0.2–0.35 mm long. (Anthers n.v.). Pedicel 2.6–3 mm long, less than half as long as the sessile spikelet, setose on the edges, with hairs 3.9–6 mm long. Pedicelled spikelets with 1 sterile to 1 male floret, 7.1–7.95 mm long. Lower glume smooth, glabrous to distally setulose, mucinous to mucronate, with mucro 0–8 mm long. Upper glume mucinous. Anthers c. 4.1 mm long.

Distribution and ecology: SE Thailand (Prachinburi: Choburi). Dry hill; at c. 75 m altitude.

Notes: *Chrysopogon perlaxus* is very similar to *C. fulvus* (Spreng.) Chiov., especially because of the peculiar tuft of hairs on the back of the upper glume of the sessile spikelet. They may be distinguished as follows:

-. Ligule 0.2–0.5 mm long. Panicle 1.5–3 cm wide, pale yellow, raceme peduncles puberulous. Sessile spikelets lower glume distally pilulose. Pedicel 1–2.5 mm long.....*Chrysopogon fulvus*

-. Ligule 0.6–1.1 mm long. Panicle 4–6 cm wide, purplish, raceme peduncles smooth to scaberulous. Sessile spikelets lower glume glabrous. Pedicel 2.6–3 mm long.*Chrysopogon perlaxus*

13. *Chrysopogon serrulatus* Trin., Mem. Acad. Sc. St. Petersburg. VI, 2 (1832) 318; Icon. Gram. 3 (1835) t. 331; *Andropogon trinii*

Steud., Syn. 1 (1854) 395, non *A. serrulatum* Link (1827); *Chrysopogon trinii* (Steud.) Watson in Atkins, Gaz. N.W. Prov. India 10 (1882) 392, nom. superfl. (NB Watson cited also *C. serrulatus* and therefore should have used that combination); *Andropogon trinii* var. *genuinus* Hack., Mon. Androp. (1889) 558, nom. inval.; *Andropogon monticola* var. *trinii* (Steud.) Hook.f., Fl. Br. Ind. 7 (1896) 193; *Chrysopogon montanus* var. *serrulatus* (Trin.) Stapf, Fl. Trop. Afr. 9 (1917) 160, nom. superfl.; *Chrysopogon fulvus* subvar. *serrulatus* (Trin.) Roberty, Boissiera 9 (1960) 284, 287, nom. inval. **Type:** Wallich (= 8791: 'Nepal, Ao 1821') in Hb. Trinius 338.01 (holo: LE, IDC microfiche BT-16/1, K neg. 14023; iso: K, IDC microfiche 7394).

[*Chrysopogon fulvus* auct. non Chiov.]

Perennials. Culms 0.3–1 m tall. Ligule 0.2–0.4 mm long. Leaf blades flat to conduplicate, 17–30 cm by 2.25–5 mm, adaxially glabrous, throat pilose. Panicle 3–12 by 1–2 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple to branched, 1–5 cm long. Raceme peduncles 1–3 cm long, smooth to puberulous, with a terminal triad. Sessile spikelets 5–8.5 mm long (incl. callus), callus oblique, pungent, 0.9–1.5 mm long, setose, with hairs 1.6–1.9 mm long, golden. Lower glume smooth, glabrous to distally pilulose, with apex acute. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro 6–10 mm long. Second lemma awned, the awn exserted, geniculate with contorted column and straight arista, 18–30(–35) mm long, with column puberulous, with hairs 0.1–0.15 mm long. Anthers 3, 2.25–2.85 mm long. Pedicel 1.9–2.6 mm long, less than half as long as the sessile spikelet, setose on the edges, with hairs 1.25–2.1 mm long. Pedicelled spikelets with 1 male floret, (3–)5–8 mm long. Lower glume scaberulous to smooth, glabrous to setulose, mucronate, with mucro (1.5–)3.5–10 mm long. Upper glume muticous to mucronate, with mucro 0–6 mm long. Anthers 2.25–3.5 mm long. $2n = 20, 40, 80$.

Distribution, habitat and ecology: Rather disjunct: S Africa, Madagascar, Afghanistan and N India to Burma, Sri Lanka, S Thailand [Satun ('Setul'); Trang], Malesia (Malay Pen.: Pahang, Tokong Burong Isl., between P. Tioman and the mainland; S Sumatra, near Lahat). Cultivated in Manila at least between 1951 and 1955. Open, rocky slopes, or in guano of birds nesting among its tussocks (about the only vegetation on T. Burong Isl.); at 0 to 600 m altitude.

Uses: Considered to be good fodder before flowering (when the awned spikelets, that may be harmful to snout and eyes are still absent); soil binder.

Vernacular name: Golden beard grass (E.).

Notes: *Chrysopogon serrulatus* is very similar to *C. orientalis* and is perhaps only a form of that species; see the general key and under *C. fulvus* for differences. The latter species differs mainly by the curious tuft of fulvous hairs on the back of the upper glume of the sessile spikelet. This taxon is only found in the area between Sri Lanka and Thailand. The Malesian material of *C. serrulatus* has large spikelets and lacks the tuft of hairs on the back of the upper glume of the sessile spikelet, and therefore, if the two taxa are to be kept separate, seems better placed in *C. serrulatus*.

14. *Chrysopogon subtilis* (Steud.) Miq., Fl. Ind. Bat. 3 (1857) 492; *Andropogon subtilis* Steud. [in Zoll., Syst. Verz. (1854) 59, nom. nud.] Syn. 1 (1854) 396. **Type: Zollinger 2815 (holo: P).**

Annuals. Culms 0.1–0.4 m tall. Ligule 0.15–0.4 mm long. Leaf blades flat to conduplicate, 1.2–7 cm by 0.7–2.6 mm, adaxially glabrous to sparsely pilose, with margins pectinate. Panicle 1–4 by c. 1 cm in outline, with few branches and spikelets, pale yellow; lowermost branches solitary to paired, with longest branch simple, 0.7–1 cm long. Raceme peduncles 0.4–0.6 cm long, smooth to scaberulous, with a terminal triad. Sessile spikelets 4.5–6 mm long (incl. callus), callus oblique, pungent, 1.5–2.25 mm long, setose, with hairs 1.1–1.95 mm long, golden (bleaching to whitish). Lower glume smooth, distally tuberculate and setulose (not

tuberculate in Sumba), with apex obtuse. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro (5.6–)6.75–11.25 mm long. Second lemma awned, the awn exerted (terminal, no lobes of lemma at base!), geniculate with contorted column and straight arista, 24–36 mm long, with column puberulous, with hairs 0.05–0.15 mm long. Anthers 2 or 3, 0.85–1.2 mm long (up to 1.65 mm in Sumba). Pedicel 1.85–3.5 mm long, more than half as long as the sessile spikelet, glabrous, smooth. Pedicelled spikelets in Sumba with 1 male floret, elsewhere reduced to only 2 glumes, (2.6–)3–4.5 mm long (up to 6 mm in Sumba). Lower glume smooth, distally puberulous, mucicous to mucronate, with mucro 0–1.65 mm long. Upper glume mucicous. Anthers c. 2.25 mm long (in Sumba).

Distribution, habitat and ecology: Malesia (E Java: Besuki, Pasuruan; Madura; Lesser Sunda Isl.: Sumba; Philippines: Luzon, Batangas Province, Nasugbu Bay). A distribution reminiscent of that of *Sclerachne punctata* R. Br., which is found in Java, Madura, and Luzon, and of *Diectomis fastigiata* (SW.) Beauv in Malesia: E Java and the Philippines (Busuanga Isl., Hermana Mayor Isl., Luzon, and Palawan). Very dry areas with a pronounced dry season, stony, barren places, roads, sea shores, open teak forest, savannas, locally abundant; up to 300 m altitude.

Notes: This species and *C. tenuiculmis* are morphologically quite similar and quite distinct from other SE Asian and Australian species, with the present species most advanced. Both have a peculiar sessile spikelet with an abruptly contracted apex of the gibbose lower glume, which in some cases may become 2-awned (as in the type of *C. tenuiculmis*). Such awns have also been seen in *C. orientalis*, q.v. The Sumba specimens examined have well-developed, male pedicelled spikelets with large anthers. In this, the taxon is even more similar to *C. tenuiculmis*.

-. Annuals. Lowermost longest branch of the panicle 0.7–1 cm long. Raceme peduncles 0.4–0.6 cm long. Callus hairs 1.1–1.95 mm long. Awn 24–36 mm long. Sessile spikelets anthers 0.85–1.2 mm long.....*Chrysopogon subtilis*

-. Perennials. Lowermost longest branch of the

panicle 1.4–2.5 cm long. Raceme peduncles 0.8–1.5 cm long. Callus hairs 1.9–2.55 mm long. Awn 14–25 mm long. Sessile spikelets anthers 1.5–2.25 mm long.....*Chrysopogon tenuiculmis*

15. *Chrysopogon tenuiculmis* Henr., Blumea 4 (1941) 532. **Type:** *Iboet* 151 (holo: L; iso: BO, K).

[*Chrysopogon gryllus* auct. non Trin.]

Perennials. Culms 0.3–0.6(–1) m tall. Ligule 0.2–0.6 mm long. Leaf blades flat to conduplicate, 5–13(–22) cm by (1.2–)2–3(–9) mm, adaxially glabrous to pilose. Panicle (3–)5–8 by 1–2.5(–3.5) cm in outline, with few branches and spikelets, pale yellow to purplish; lowermost branches solitary to whorled, with longest branch simple, 1.4–2.5 cm long. Raceme peduncles 0.8–1.5 cm long, scaberulous, with a terminal triad. Sessile spikelets (4.1–)5.25–6(–6.5) mm long (incl. callus), callus oblique, pungent, (0.75–)1.5–2 mm long, setose, with hairs 1.9–2.55 mm long, golden. Lower glume spinulose to smooth, distally tuberculate and setulose, with apex obtuse, or mucronate, or bi-dentate and mucronate, with mucro 0–3 mm long. Upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, with mucro (2.6–)4–8.6 mm long. Second lemma awned, the awn exerted, geniculate with contorted column and straight arista, 14–25(–28) mm long, with column puberulous, with hairs 0.15 mm long. Anthers 3, 1.5–2.25 mm long. Pedicel (2.1–)2.6–4 mm long, more than half as long as the sessile spikelet, glabrous, smooth. Pedicelled spikelets with 1 male floret, (4.5–)5.25–7(–8.25) mm long. Lower glume scaberulous to smooth, setulose to distally puberulous, mucicous to mucronate, with mucro 0–4.5 mm long. Upper glume mucicous to mucronate, with mucro 0–0.45 mm long. Anthers 2.1–2.8 mm long. $2n = ?$

Distribution, habitat and ecology: Lesser Sunda Isl. (Sumba, Flores, Lombok, Roti, Timor?, Wetar). Dry, barren soil, Eucalypt forest behind shore, locally dominant in pastures up to 1400 m altitude.

Notes: Henrard (1941) erroneously reported that the upper glume of the sessile spikelet of this species would be mucicous. De Castro

[Garcia de Orta 12 (1964) 52] mentioned *C. gryllus* for Timor (Gomes da Silva s.n., COI, n.v.), but this probably refers to *C. tenuiculmis*. See under *C. subtilis* for the close similarity with *C. tenuiculmis*. *Chrysopogon serrulatus* is morphologically somewhat similar, but may be distinguished as follows:

-. Panicle with many branches and spikelets. Sessile spikelets lower glume glabrous to distally pilulose. Pedicel less than half as long as the sessile spikelet, setose on the edges.
.....*Chrysopogon serrulatus*

-. Panicle with few branches and spikelets. Sessile spikelets lower glume distally tuberculate to setulose. Pedicel more than half as long as the sessile spikelet, glabrous, smooth
.....*Chrysopogon tenuiculmis*

16. *Chrysopogon zizanioides* (L.) Roberty, Bull. Inst. Franç. Afr. Noire 22 (January 1960) 106; Boissiera 9 (July 1960) 291, isonym; *Phalaris zizanioides* L., Mant. 2 (1771) 183; *Sorghum zizanioides* (L.) Kuntze, Rev. Gen. Pl. 2 (1891) 791; *Andropogon zizanioides* (L.) Urban, Symb. Antill. 4 (1903) 79; *Vetiveria zizanioides* (L.) Nash in Small, Fl. SE U.S. (1903) 67; *Holcus zizanioides* (L.) Kuntze ex Stuckert, Ann. Mus. Nac. Buenos Aires 11 (1904) 48; *Anatherum zizanioides* (L.) Hitchc. & Chase, Contr. U.S. Nat. Hb. 18 (1917) 285; *Vetiveria zizanioides* var. *genuina* A. Camus, Bull. Mus. Nat. Hist. Nat. Paris 25 (1919) 673, nom.inval.; *Rhaphis zizanioides* (L.) Roberty, Petite Fl. Ouest-Afr. (1954) 403, nom.inval. **Type: *Koenig* in Hb. Linn. 78.12 (holo: LINN, IDC microfiche).**

Andropogon muricatus Retz., Obs. Bot. 3 (1783) 43; *Anatherum muricatum* (Retz.) Beauv. Agrost. (1812) 128 ('*mucronatum*'), 150, t. 22, f. 10; *Vetiveria muricata* (Retz.) Griseb., Fl. Br. W. Ind. (1864) 560; *Chamaeraphis muricata* (Retz.) Merr., Enum. Phil. Fl. Pl. 1 (1923) 75 pro comb. corrected in 1925 p. 459 to *C. squarrosa* (L.f.) Merr., **Type:** *Koenig* in Hb. Retz. (holo: LD, fragm. in K).

Andropogon nardus Blanco, Fl. Filip. (1837)

39. Type: not extant; Neotype: *Merrill* Sp. Blanc. 355 (holo: US; iso: A, BM, BO, K, L, MO, NSW, NY, P) here designated.

Vetiveria zizanioides var. *tonkinensis* A. Camus, Bull. Mus. Nat. Hist. Nat. 25 (1919) 674. **Lectotype:** *Anon.* 73 'Prairie de Yen Phu, Hanoi, 2 Aout 1907' (holo: P; here proposed).

[*Andropogon squarrosus* auct. non L.f.]
(See note).

[*Andropogon squarrosus* var. *genuinus* auct. non Hack.]

[*Vetiveria nemoralis* auct. non A. Camus]

[*Vetiveria odorata* auct. non Virey.]

[*Vetiveria odoratissima* auct. non Bory.]

Perennials. Culms 1.5–2.5 m tall. Ligule 0.3–0.75 mm long. Leaf blades conduplicate, 23–94 cm by 2.5–7 mm wide, adaxially pilose in the lower part. Panicle 20–33 by 2.5–6 cm in outline, with many branches and spikelets, purplish; lowermost branches whorled, with longest branch simple, 5.5–12 cm long. Raceme peduncles 1–4 cm long, smooth to scaberulous, with 6–14 spikelet groups per branch, joints 3.75–6.75 mm long, glabrous to setulose. Sessile spikelets 3.75–6 mm long (incl. callus), callus rounded, 0.6–0.8 mm long, laterally ciliate at base, especially near the base of the pedicel, with hairs 0.1–1.35 mm long, white. Lower glume spinulose, aculeate, especially on the nerves and setulose, with apex acute. Upper glume aculeate, especially on the midrib and midrib distally setulose, without a dorsal fringe of hairs, with apex muticous. Second lemma muticous to mucronate, the awn usually enclosed, straight, 0–1.95(–4.5) mm long, with column glabrous. Anthers 3, 1.65–2.25 mm long. Pedicel 2.25–4.3 mm long, more than half as long as the sessile spikelet, scaberulous. Pedicelled spikelets with 1 male floret, 2.85–4.6 mm long. Lower glume scaberulous, aculeate, especially on the nerves, muticous. Upper glume muticous. Anthers 1.65–2 mm long. $2n = 20$.

Distribution, habitat and ecology: Said (Nat. Res. Council 1993) to have come originally from

India, now distributed world-wide, and much more common and wide-spread than suggested by herbarium material: Thailand, Malay Pen., Singapore, Sumatra (*Benecke* 276, sin. loc.; L), Java, Madura, Kangean Isl., Borneo (Kalimantan; Sabah), Philippines, Lesser Sunda Isl. (Sawu: *Proppe* s.n., L), New Guinea (Chimbu Province). Low damp sites, swamps, bogs, but persists when planted on a multitude of soils for perhaps centuries; at 0 to 1500 m altitude (probably higher, for cultivated in Chimbu, Papua New Guinea).

Uses: The roots provide the vetiver oil used in perfumes and cosmetics. The fragrance resembles that of sandalwood and is long-lingering; used as a base in the more heavy oriental perfumes; in Malaya they are used in curries; roots used for weaving fragrant mats, fans, hats, etc. See the extensive discussion by Chadha [Wealth of India 10 (1976) 451]. Young leaves eaten by cattle, older ones eaten by carp. Used for thatching. The species is regarded as an eminent soilbinder with great potential in erosion control (Nat. Res. Council, 1993, where a large amount of information on many aspects of the species is given) and has been introduced as such all over the world in tropical to Mediterranean climates. However, in W. Sumatra, Central and West Java, the (illegal) harvesting of the roots resulted in a series of trenches across the landscape which subsequently eroded. This became such a problem that a number of provinces passed laws prohibiting the growing of the grass H. Siwon, Padang (pers.com.). A weak infusion or a paste of the roots is used as a febrifuge, a powder in bilious complaints. See also De Guzman & Oyen [PROSEA 19 (1998) 167–172, illus.].

Vernacular name: Khas-khas, Vetiver (E.), akar wangi (Mal.).

Notes: The epithet 'squamroza' has been applied to this species based on *Andropogon squarrosus* L.f. [Suppl. Pl. (1781) 433], which is a dubious name possibly typified by Koenig in Hb. Linn. 1211-7, which is *Pseudoraphis spinescens* (R. Br.) Vickery [see Bor, Grasses (1960) 354].

There are two forms of *C. zizanioides*: a wild, flowering and seeding one thought to

have originated in N India with shallow roots that contain the highly laevorotatory 'Vetiver oil', and a widely-cultivated, usually non-flowering and sterile one thought to origin from S India with deep roots that contain the dextrorotatory 'Oil of Vetiver roots'. Ramanujam & Kumar [Ind. J. Gen. & Pl. Br. 24 (1964) 144] have suggested that two species are involved, but indicate that there are 'not any gross morphological character' to differentiate between them. The characters they listed can only be seen in entire, living clumps, and are of little use in identifying herbarium material. These are not to be equated with *C. festucoides* and *C. zizanioides*, as the first, as far I have seen, occurs in India in Assam only, and is said to contain no oil. Kumar [Science & Culture 29 (1963) 152] reported a clone in which nearly all pedicelled spikelets had perfect florets. For the probable misapplication of '*V. nemoralis*' in Thailand for forms of this species, see under *C. festucoides*.

Non-Asian Species

17. *Chrysopogon argutus* (Steud.) Trin. ex B.D. Jackson, Ind. Kew. 1 (1893) 124, 530; 2 (1895) 704 (isonym); [*Chrysopogon argutus* Steud., Nomencl., ed. 2, 1 (1840) 360, based on *Rhaphis arguta* Nees in hb. Berol.: nomen]; *Andropogon argutus* Nees ex Steud., Syn. 1 (1854) 391; *Vetiveria arguta* C.E. Hubb., Kew Bull. (1939) 654. **Type:** Hb. Nees (holo: B, lost, fide H. Scholz, in litt.)

Andropogon squarrosus var. *chrysopogonoides* Hack., Mon. Androp. 6 (1889) 544; *Vetiveria zizanioides* var. *chrysopogonoides* A. Camus, Bull. Mus. Nat. Hist. Nat. Paris 25 (1919) 674. **Type:** Bojer s.n. (holo: W; iso: K).

Distribution and Habitat: Mauritius, Rodriguez, river banks.

Notes: The combination used above apparently has escaped bibliographers. For some reason Jackson gave Trinius ex Steud. as the author of the combination, the wrong reference (p. 360, must be 391), where Steudel has *Andropogon* (!) *argutus* Nees (!), and Australia (perhaps because Hackel l.c. 564 suggested that) as the

provenance. Still, the combination must be regarded as valid and correct.

- 18. *Chrysopogon benthamianus*** Henr., Blumea 4 (1941) 532 [*Holcus gryllus* auct. non R.Br.: R. Br., Prod. 1 (1810) 199, pro descr. & specim.; *Chrysopogon gryllus* auct. non Trin.: Benth., Fl. Austr. 7 (1878) 537]. **Lectotype:** *R. Brown* 6189 (holo: BM, photo in BRI, photocopy in K; here proposed).

Chrysopogon fallax S.T. Blake, Univ. Queensl. Papers, Dept. Biology 2 (1944) 9, nom. superfl. **Type:** *S.T. Blake* 8108 (holo: BRI no. 8033; iso: K, NSW).

Notes: The combination proposed by Henrard was the realization of a chance remark by Hubbard (1938) that Bentham (1878) (and others before and after him) had misidentified Australian specimens of an undescribed species with *Chrysopogon gryllus* (L.) Trin. Henrard based himself on Bentham's description and apparently for that reason called the species *C. benthamianus* Henr. Significant are his earlier statements (on *C. gryllus*): "The 5 subspecies of Hackel are at present accepted as distinct species" and he then enumerates *C. gryllus* s.s., *C. echinulatus*, *C. pallidus*, *C. glabratus* Trin., and *C. calcaratus* (Hack.) Henr. Then, "According to Hubbard, Bentham's *Chrysopogon gryllus* is a distinct species" and "the species which Bentham named *C. Gryllus* represents an undescribed species, while *C. Gryllus* var. *pallidus* (R.Br.) Benth. is also quite distinct. Bentham's *Chrysopogon Gryllus*, being described, we can give it another name *Chrysopogon Benthamianus*. nom. nov.", followed by a full and direct reference to Bentham (1878).

It is therefore obvious that Henrard excluded the reference to *Andropogon gryllus* L. and its type, and all combinations based on it and intended to rename the Australian taxon previously and erroneously called *C. gryllus* by Bentham and *H. gryllus* by R. Brown. Although Henrard said the species was described by Bentham in 1878, technically this is incorrect, for it was not in Latin, as required in 1941. However, indirectly he does refer to a

Latin description, for Bentham cites the one given by R. Brown. It is therefore to be considered an 'error in bibliographic citation (Art. 33.3, see Ex. 6, 7)'. That Henrard called it a 'nom. nov.' is also an error to be corrected under Art. 33.4, see Ex. 9. It seems to me that the obvious type is the R. Brown collection on which the validating description was based. Some have suggested that it is part of the Bentham reference, and that all references given by Bentham are syntypes, so that *Brown* 6189 is a lectotype. To please those I have called it a lectotype above.

Because of the poor communications of those war times this species was described again independently by S.T. Blake (1944) as *C. fallax*. Vickery (1961) accepted Blake's species and regarded *C. benthamianus* as superfluous because a) Bentham would have described *C. gryllus* proper, b) his specimens would be a mixture of *C. fallax* and *C. pallidus*, and c) Henrard did not appoint a type.

As to the first, there is no Article that makes a name illegitimate because its description is faulty or does not even apply.

As to the second, Bentham recognized a variety *pallidus* next to his *C. gryllus*, and Henrard clearly excluded that (see above). In Vickery's time, a name based on discordant elements was a reason for its rejection, but as this is clearly against the type method, that Article (then 70) has been deleted from the Code since and cannot be invoked. There is no indication that Bentham's specimens would be such a mixture of two species, anyway. And even if it was, a lectotypification (also proscribed by the then Art. 70) according to Henrard's intentions could be made.

As to the third, for the name of a new taxon the appointment of a type was not required until 1958 (Art. 37.1).

Regarding Brown's descriptions, it is known that his 'species were ... described as collected in Australia itself, ... written out in the homeward voyage' (Hooker, 1890; cited by Stearn, 1960, p. xxv). This was apparently also the case in the present situation for he specifically mentioned that the lowermost leaf

sheaths are subsericeous. This is so in the Australian species, but not in *C. gryllus* from Europe. Blake, too, remarked that Brown's name referred to *C. fallax* 'as to the description and specimens' (l.c., p. 13; emphasis mine).

As Blake stated that he included all that was cited, *C. fallax* is superfluous because it also included all the elements referred to by Henrard [Art. 52.1, and 52.2 (a)]. Blake, because he was unaware of Henrard's action correctly appointed a type (Blake 8108) for *C. fallax*, so this name, although superfluous, remains heterotypic from *C. benthamianus* under Art. 7.5.

- 19. *Chrysopogon elongatus*** (R. Br.) Benth., Fl. Austr. 7 (1878) 538; *Holcus elongatus* R. Br., Prodr. 1 (1810) 200; *Sorghum elongatum* (R. Br.) Beauv., Agrost. (1812) 131, 164, 178; *Andropogon elongatus* (R. Br.) Spreng., Syst. Veg. 1 (1825) 287; *Rhaphis elongatus* (R. Br.) Chase, Contr. U.S. Nat. Hb. 24 (1925) 205; *Vetiveria elongata* (R. Br.) Stapf ex C.E. Hubb., Kew Bull. (1934) 444. **Type:** *R. Brown* 6193 [holo: BM, photo in BRI, K; iso: BRI, K, photo in BRI; MEL, photo in BRI].

Distribution and habitat: Australia (Northern Territory to Queensland). Sea shores, dunes, mangrove, edge of marsh, moist *Melaleuca* stands.

Uses: Grazed by cattle.

Notes: The anthers of the sessile spikelet appear to be staminodial. This species was erroneously reported for Papua New Guinea by Reeder [J. Arn. Arb. 29 (1948) 360]. The material belongs to *C. micrantherus* Veldk. The two species may be distinguished as follows:

- Panicle 28–30 cm long, pale yellow. Callus hairs 3.75–5.6 mm long. Column glabrous. Awn exserted to enclosed, straight to geniculate with contorted column and straight arista, 1.9–6.5(–8.25) mm long. Pedicelled spikelets 6.75–9.75 mm long. *Chrysopogon elongatus*
- Panicle 19–27 cm long, purplish. Callus hairs 1.8–3.6 mm long. Column puberulous. Awn exserted, geniculate with contorted column and

straight arista, 5.25–14 mm long. Pedicelled spikelets 5.7–7.85 mm long.
..... *Chrysopogon micrantherus*

- 20. *Chrysopogon fulvibarbis*** (Trin.) Veldk., **comb. nov.**; *Andropogon fulvibarbis* Trin., Mem. Acad. Sc. St. Petersburg. VI, 2 (1832) 287; *Vetiveria fulvibarbis* (Trin.) Stapf, Fl. Trop. Afr. 9 (1919) 158; *Anatherum fulvibarbe* (Trin.) Keng, Sinensia 10 (1939) 314; *Rhaphis zizanioides* subvar. *fulvibarbis* (Trin.) Roberty, Petite Fl. Ouest-Afr. (1954) 403, nom. inval.; *Chrysopogon zizanioides* var. *fulvibarbis* (Trin.) Roberty, Boissiera 9 (1960) 291, nom. inval. **Type:** *Sabine* 'Accra 19' in Hb. Trinius 0207.1 (holo: LE, IDC microfiche BT-16/1).

Distribution and habitat: W Africa (S Mali, Ghana to Cameroon). Flood plains and savannas; at up to 300 m altitude.

Notes: Oil has been reported for the roots [Burkill, Useful Pl. W. Trop. Afr. 2 (1994) 376]. The inflorescence branches have up to 6 spikelet groups, the callus is oblique, pungent, c. 1.6 mm long, and hairy, the up to 20 mm long awn is geniculate with a contorted puberulous column, making this an intermediate taxon between *Chrysopogon* and *Vetiveria*.

- 21. *Chrysopogon gryllus*** (L.) Trin., Fund. Agrost. (1822) 188; *Andropogon gryllus* L., Cent. Pl. 2 (1756) 332; *Holcus gryllus* (L.) R. Br., Prodr. 1 (1810) 199 pro comb.; *Pollinia gryllus* (L.) Spreng., Pl. Pugill. 2 (1815) 10, comb. incorr. **Type:** *Séguier* s.n. in Hb. Linn. 1211.2 (holo: LINN, IDC microfiche).

Notes: This species has been recorded for the Malesian area, based on misidentifications found in the literature:

It was noted for the Philippines (Luzon, Panay) by F.-Vill. [Nov. App. (1882) 316], which was possibly based on specimens of *C. nemoralis* [cf. Merrill, Enum. Philip. Fl. Pl. 3 (1923) 45], or *C. subtilis*, or something else altogether. It has been mentioned by De Castro [Garcia de Orta 12 (1964) 52] for Timor, but the species concerned is likely to have been *C.*

tenuiculmis Henr., q.v. It has been recorded for Papua New Guinea (Central Province, Boku) by F.M. Bailey [Queensl. Agric. J. 23 (1909) 220; Ms. Schlenker s.n., n.v., not found in BRI, so perhaps not of a *Chrysopogon* (or *Vetiveria*) species]. It is not known to me what this may be, no *Chrysopogon* taxon is presently known from the Central Province of Papua New Guinea (other than *C. aciculatus*, of course).

22. *Chrysopogon gryllus* subsp. *echinulatus* (Nees ex Steud.) Cope, Kew Bull. 35 (1980) 701, map 1; Fl. Pakistan 143 (1982) 301; [*Rhaphis echinulata* Nees in Royle, Ill. Bot. Him. (1840) 417, nomen]; *Andropogon echinulatus* Nees ex Steud., Syn. 1 (1854) 397; *Chrysopogon echinulatus* (Nees ex Steud.) Wats. in Atk., Gaz. NW Ind. 10 (1882) 392; *Andropogon gryllus* L. subsp. *echinulatus* (Nees ex Steud.) Hack., Mon. Androp. (1889) 552. **Type:** Royle 226 (holo: LIV).

Notes: See introduction. *Rhaphis echinulata* Nees in Royle (1840) was not validly published, so the epithet with a different authorship ('Nees ex Steud.') dates from 1854. Cope's combination is to be regarded as a bibliographic error to be corrected (Art. 33.3) and is valid.

23. *Chrysopogon nigritanus* (Benth.) Veldk., comb. nov.; *Andropogon nigritanus* Benth. in Hook., Fl. Niger (1849) 573; *Andropogon squarrosus* var. *nigritanus* (Benth.) Hack., Mon. Androp. (1889) 544; *Vetiveria nigritana* (Benth.) Stapf, Fl. Trop. Afr. 9 (1917) 157; *Vetiveria zizanioides* var. *nigritana* (Benth.) A. Camus, Bull. Mus. Nat. Hist. Nat. Paris 25 (1919) 674; *Rhaphis zizanioides* var. *nigritana* (Benth.) Roberty, Petite Fl. Ouest-Afr. (1954) 403, nom. inval.; *Chrysopogon zizanioides* var. *nigritanus* (Benth.) Roberty, Bull. Inst. Franç. Afr. Noire 22 (January 1960) 106; Boissiera 9 (July 1960) 291, isonym. **Type:** Vogel s.n. (holo: K).

Distribution, habitat and ecology: Tropical Africa; said to have been introduced elsewhere. Stream sides, swampy flood plains and other

seasonally flooded places, somewhat salt-resistant, 0–100 m in Africa.

Uses: Roots varyingly aromatic, probably according to edaphic conditions. Locally grown in Africa for its oil [Burkill, Useful Pl. W. Trop. Afr. 2 (1994) 375]. Young shoots eaten by cattle, older ones used for thatching and straw, said to repel termites. Sometimes grown as an ornamental in Africa. Good soil binder.

Notes: Very similar to *C. festuroides*, q.v. This species has been reported for Sri Lanka [Clayton & Renvoize, Fl. Trop. E. Afr. Gram. 3 (1982) 739; but was not mentioned by Dassanayake et al., Rev. Handbook Fl. Ceylon 8 (1995) and earlier floras], Thailand, Malaysia, Philippines, but all these records are probably based on misidentified specimens of *C. festuroides* or *C. zizanioides*. For instance the specimens from Cambodia labeled as *V. zizanioides* var. *nigritana* by A. Camus in P are *C. zizanioides* s.s.

Because *C. zizanioides* is known to be cultivated in Africa, and since the differences with *C. nigritana* are so slight, they may easily be confused, and the uses attributed to *C. nigritanus* may well pertain to *C. zizanioides*. *Chrysopogon nigritanus* is a wild species which may be expected to seed freely; use of the species for soil binding is to be discouraged, as it will escape and become a pest.

Chrysopogon nigritanus within the *C. zizanioides*-complex is most similar to *C. festuroides*. For the differentials see under the latter species.

As Hackel (1889) cited var. *aristatus* Buse (now *C. festuroides*) with a query when he proposed var. *nigritanus*, the latter combination is therefore legitimate.

24. *Chrysopogon oliganthus* Veldk., nom. nov.; *Vetiveria pauciflora* S.T. Blake, Univ. Queensl. Pap. 2 (1944) 20, non *Chrysopogon pauciflorus* Vasey (1883). **Type:** S.T. Blake 8639 (holo: BRI).

Distribution, habitat and ecology: Australia (W Australia, N Territory, Queensland). Locally vegetation forming in sandy river bed, edges

of swamps and creeks, in shallow water.

- 25. *Chrysopogon rigidus*** (B.K. Simon) Veldk., **comb. nov.**; *Vetiveria rigida* B.K. Simon, *Austrobaileya* 3 (1989) 95, t. 10. **Type:** *J.R. Clarkson* 4419 (holo: BRI, holo, fragm. in L; iso: CANB, K, MBA, QRS).

Distribution and ecology: Australia (Queensland, Cook District). Near waterhole in *Corymbia confertiflora* woodland.

Note: No taste to the roots (pers obs.)

Excluded names:

- 26. *Chrysopogon fuscus*** (Presl) Trin. ex Steud., *Nomencl.*, ed. 2, 1 (1840) 91, 360; *Andropogon fuscus* Presl, *Rel. Haenk.* 1 (1830) 342; *Sorghum fuscum* (Presl) Miq., *Fl. Ind. Bat.* 3 (1857) 503. **Type:** *Haenke* s.n. (holo: PR; iso: Hb. Trinius 211.03, LE, microfiche IDC BT-16/1)..

This is *Sorghum nitidum* (Vahl) Pers.

- 27. *Chrysopogon leucotrichus*** A. Camus, *J. Agric. Trop. & Bot. Appl.* 11 (1955) 200. **Type:** *Schmid* 2461 (holo: P).

= ***Capillipedium leucotrichum*** (A. Camus) Schmid ex Veldk., **comb. nov.**

This combination was not validly published by Schmid [*J. Agron. Trop.* 13 (1958) 206] because there was no full and direct reference to the basionym as required by Art. 33.2.

- 28. *Chrysopogon strictus*** (Nees) Jackson, *Ind. Kew.* 1 (1893) 95; 2 (1895) 704, both nom.inval., in synonym; *Rhaphis stricta* Nees in Hook., *J. Bot. Kew Misc.* 2 (1850) 99; *Andropogon leptanthus* Steud., *Syn.* 1 (1854) 391, non *Andropogon strictus* Host. (1802). **Type:** *Cuming* 1400 (holo: CGE; iso: L, P).

This is *Bothriochloa bladhii* (Retz.) S.T. Blake

This combination was not accepted by Jackson, as it is printed in italics and is equated with *Andropogon intermedius*, a synonym of *B. bladhii*.

- 29. *Chrysopogon villosulus*** (Steud.) Watson in Atkins, *Gaz. NW Prov. India* 10 (1882) 392; Vidal [Phan. Cuming, Philip. (1885) 29, 158, nomen] *Revis. Pl. Vasc. Filip.* (1886) 291, isonym; *Andropogon villosulus* Nees ex Steud., *Syn.* 1 (1854) 397. **Syntypes:** *Royle* 93 (LIV, P), *Royle* 282 (LIV, photo in BRI; P).

This is *Capillipedium parviflorum* (R. Br.) Stapf.

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Identifications between brackets are for material not yet seen, but for which the identification seemed fairly certain.

aci = *Chrysopogon aciculatus* (Retz.) Trin.bor = *Chrysopogon borneensis* Henr.cel = *Chrysopogon celebicus* Veldk.fes = *Chrysopogon festuroides* (Presl) Veldk.fil = *Chrysopogon filipes* (Benth.) Reederful = *Chrysopogon fulvus* (Spreng.) Chiov.int = *Chrysopogon intercedens* Veldk.law = *Chrysopogon lawsonii* (Hook.f.) Veldk.mic = *Chrysopogon micrantherus* Veldk.nem = *Chrysopogon nemoralis* (Balansa) Holtt.ori = *Chrysopogon orientalis* (Desv.) A. Camusper = *Chrysopogon perlaxus* Borser = *Chrysopogon serrulatus* Trin.sub = *Chrysopogon subtilis* (Steud.) Miq.ten = *Chrysopogon tenuiculmis* Henr.ziz = *Chrysopogon zizanioides* (L.) Roberty

(T) = type collection

Abbe et al. 9226; ori; Adj. Veearts Gorontalo 36: aci; Adm.s.o. Doekoewringin 34: aci; Aet 807: aci;

Afriastini 1840: aci; Alston 14606: (fes); Anang 400: aci; 585: aci.

Backer 09/06/1927: (sub); 7: (fes); 51: aci; 89: (ziz); 2056: aci; 2563: aci; 4095: aci; 5144: aci; 5289: aci; 6408: aci; 6976: aci; 10054: aci; 10568: aci; 11112: aci; 11248: aci; 11948: aci; 12269: aci; 12977: sub; 13232: aci; 13975: aci; 13996: aci; 16914: aci; 17125: aci; 17271: aci; 17432: aci; 17786: aci; 18476: aci; 19222: aci; 19919: aci; 20428: (sub); 20593: ziz; 21266: sub; 21949: aci; 23033: aci; 23415: aci; 23510: fes; 23511: (fes); 23886: aci; 24064: aci; 24337: sub; 24625: sub; 26709: (ziz); 26974: aci; 27114: aci; 27683: (fes); 27698: ziz; 27760: (fes); 27775: (fes); 30016: ziz; 30055: sub; 30338: aci; 30750: sub; 30761: sub; 32511: fes; 33386: aci; 33387: aci; 35102: (fes); 36550: sub; 37270: ziz; Bakhuizen v.d. Brink 56: aci; 5753: aci; Barber 366: aci; bb (Ostwald 84) 9024: aci; Beguin 21: aci; 29: aci; 53: aci; 84: aci; 118: aci; 659: aci; K 3: aci; Belcher 859: fes; Benecke 276: ziz; Beumée 130: aci; 877: aci; 2652: aci; van Beusekom et al. 3816: ori; BF 801 (Borden): aci; Bloembergen 3071: aci; 3753: ten; Bor S-49: aci; Borden 801: aci; Bradley 48: aci; 49: ori; Brass 6045: mic; 6283: mic; 6426: aci; 8460 (T): fil; 8579 (T): mic; 22084: aci; 28156: aci; Brinkman 124: aci; Broekhuijsen 14: aci; Brooke 9816: aci; BS 4186 (Curran): aci; 7860 (Ramos): aci; 8749 (McGregor): aci; 11542 (Robinson): aci; 15751 (Clemens): fes; 18873 (McGregor): aci; 22238 (Santos): fes; 30964 (Ramos & Edano) (T): nem; 80771 (Ramos): ziz; Bunnemeijer 70: aci; 690: aci; 1227: aci; 1325: aci; 1405: aci; 1640: aci; 2492: aci; 3718: aci; 5595: aci; 7215: aci; 8251: aci; 11025: aci; Burcham 136: aci; Burkill & Shah 2514: ser; 3224: ser; 3227: ser; Burn-Murdoch 323: ori; Buwalda 2699: aci; 3359: aci; 4499: aci; 5800: aci; 7868: aci; 7885: ziz.

Carr 11033: aci; Chantaranonthai & Parnell 90/742: ori; Charoenphol et al. 4070: ori; 5036: ser; Civiel Gezaghebber 1: (ten); Civielgezaghebber van Sawoe 13/09/1918: (ten); Clason A 29: sub; Clemens 3051: ori; 4456: ziz; 18205: ziz; 18221: aci; Coert 1816: aci; Colfs 204: aci; Copeland 549: aci; Cruttwell 98: aci; 139: aci; Cuming 555: aci; Curtis 1799: aci; 1819: ziz.

Darbyshire 660: aci; 1155: aci; Deguchi et al. 6257: aci; DeKalb Russell 24 Aug 943: aci; DeVore & Hoover 225: aci; Dissing 2508: aci; 2672: aci; Djamhari 420: aci; Docters van Leeuwen 00/00/1909: aci.

Edeling 3/1863: fes; Elbert 976: ten; Elmer 16732: aci; Endert 5271 (T): bor; 5392: (bor); Everaarts 365: aci; Eyma 1765: aci.

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de Haan 1725: aci; de Haas 6: aci; Hacker 1559: fes; Hallier 24/04/1893: aci; 616-a: aci; 616-b: aci; Harmsen 7: aci; Haviland 1934: aci; 1934: aci; Heckman 107: aci; 108: aci; Heyne 773: (ziz); den; Hitchcock 18086: aci; Hoed 249: aci; Hoekstra 5: sub; 18: sub; Holttum 21/04/ 1931: aci; 22/10/1946: ziz; Hoogland 3247: aci; Hose 65: ziz; Hosseus 160: ful; Huitema 73: aci; Hullett Jan 1894: aci; 30 Mar 1886: aci; Hume 8871: aci.

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ser; de la Savinière 83: aci; Sawyer 144: aci; 163: aci; Schiffner 35: ziz; 1500: aci; Schmutz 5444: ten; 5756: ten; Schodde & Craven 4593: aci; Seidenfaden 2219: (aci); SF 649 (Haniff) (T): ser; 2958 (Haniff & Nur): ori; 4634 (Burkill): aci; 6236: ziz; 11527 (Machado): (aci); 12512 (Burkill & Haniff), p.p.: aci; 12742 (Burkill & Haniff): aci; 15175 (Holtum): ori; 20476 (Henderson): aci; 20825 (Holtum): nem; 24600 (Holtum): aci; 25803 (Corner): ori; 25805 (Corner): aci; 25846 (Corner): nem; 29058 (Henderson): ori; 29784 (Corner): ser; 29905 (Corner): ori; 33257 (Spare): aci; 37840 (Holtum): ori; 38104 (Corner): ziz; 39060 (Sinclair): ziz; 39810 (Sinclair & Kiah): ori; Simpson & Forman 89/125: aci; van Slooten 2435: sub; E. Smith 932: aci; Sinclair 5364: aci; 7530: ori; Sirirugsa 842: aci; Smith H.M. 210: ori; Smitinand 5044: fes; 5932: ziz; 6078: ziz; Smitinand & Hambananda 8477: ori; Soares 701: (aci); 730: (aci); Sohns 00/00/1920: aci; Sørensen et al. 1964: 2060: aci; (aci); 2105: ?fes; 3700: aci; 5768: ziz; Squires 886: aci; 809: ziz; van Steenis 584: aci; 1037: aci; 3127: aci; 6733: aci; 18652: (aci); Suvathubandhu 25: aci.

Tandom 4934: aci; Teysmann 5947: (ten); Tsang 29315: aci.

Ultée 3: aci; 17: aci; Uway et al. PTU. 22: aci.

Vanoverbergh 2808: aci; 3791: ziz; Veearts Sibolga 5: aci; van der Veen 60: (ten); Veldkamp 8757: aci; Verboom 24: ser; Verdcourt 5206: aci; Verheijen 2456: ten; 2801: ten; Versteegh 83: aci; Vesterdal 85: ori; 457: ziz; Vidal 1962: aci; de Vogel 3048: aci; Volkens 117: (aci); de Voogd 2658: (ten).

Walsh 19: aci; Weber 1047: aci; Whitford 385: aci; Whyte 5/1974: ori; Williams 94: aci; 2840: aci; Winckel 122: aci; 596: aci; 1016: aci; Winkler, Hubert 2931: aci; Wiriadinata 414: ten; Wong P.W. 4 Aug 1959: aci; Worthington 12376: aci; Wray 765: aci.

Yapp 359: ori.

Zollinger 54: aci; 2815 (T): sub.